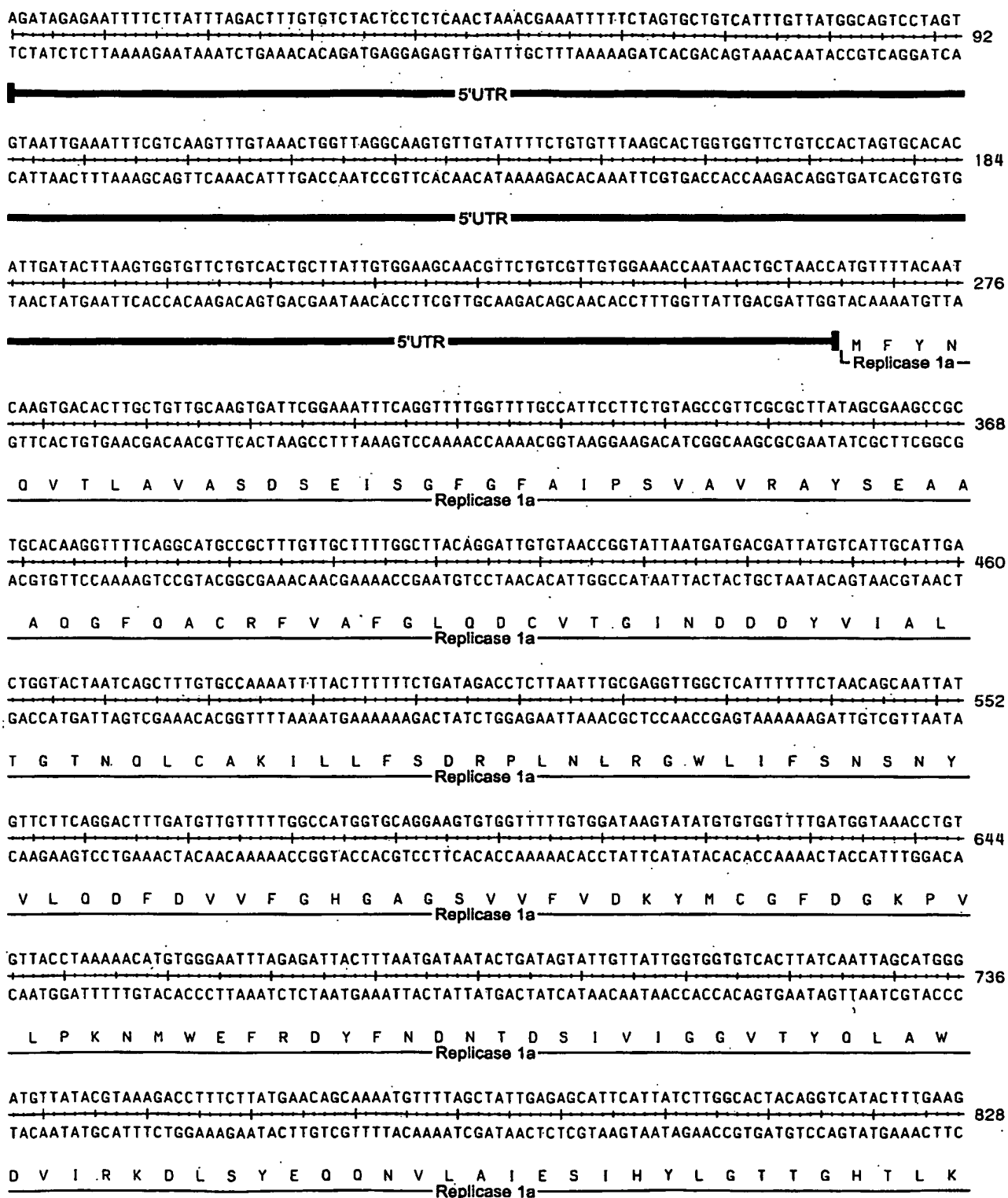


Fig. 1



TCTGGTTGCAAACCTATTAATGCCAAGCCGCTAAATATTCTTCTAAGGTTGTTTTGAGTGGTGAATGGAATGCTGTGTATAAGGCGTTTGG
AGACCAACGTTTGAGTAATTACGGTTCGGCGGATTATAAGAAGATTCCAACAAAACCTACCACTTACCTTACGACACATATTCGCAAAAC 920

S G C K L I N A K P P K Y S S K V V L S G E W N A V Y K A F G
Replicase 1a

TTCAACATTTATTACAAATGGTATATCATTGCTAGATATAATTGTTAAACAGTTTTCTTTAATGCTTTTGTTAAATGCAATTGTGGTTCTG
AAGTGGTAAATAATGTTTACCATATAGTAACGATCTATTAACAATTTGGTCAAAAGAAATTACGAAAACAATTTACGTTAACACCAAGAC 1012

S P F I T N G I S L L D I I V K P V F F N A F V K C N C G S
Replicase 1a

AGAATTGGAGTGTGGTGCATGGGATGGTTATCTATCTTCTGTTGTGGCACACCTGCTAAGAACTTTGTGTTGTTCTGGTAATGTTGTT
TCTTAACCTCACAACCGTACCCTACCAATAGATAGAAGAACAACCGTGTGGACGATTCTTTGAAACACAACAAGGACCATTACAACAA 1104

E N W S V G A W D G Y L S S C C G T P A K K L C V V P G N V V
Replicase 1a

CCTGGTGATGTGATCATCACCTCAACTGATGCTGGTGTGGTGTAAATACTATGCTGGCTTAGTTGTTAAACATATTTACTAACATTACTGG
GGACCACTACACTAGTAGTGGAGTTGACTACGACCAACACCACAATTTATGATACGACCGAATCAACAATTTGTATAATGATTGTAATGACC 1196

P G D V I I T S T D A G C G V K Y Y A G L V V K H I T N I T G
Replicase 1a

TGTGCTTTTATGGCGTGTACAGCTGTTTCATTCTGATGGAATGTTTGTGGCAACATCTTCTTATGATGCACTTTTGCATAGAAATTCATTAG
ACACAGAAATACCGCACAATGTCGACAAGTAAGACTACCTTACAAACACCGTTGTAGAAGAATACTACGTGAAAACGTATCTTTAAGTAATC 1288

V S L W R V T A V H S D G M F V A T S S Y D A L L H R N S L
Replicase 1a

ACCTTTTTGCTTTGATGTTAACACTTTACTTTCTAATCAATTACGTCTAGCTTTTCTTGGTGTCTCTGTTACAGAAGATGTTAAATTTGCT
TGGGAAAAACGAAACTACAATTGTGAAATGAAAGATTAGTTAATGCAGATCGAAAAGAACACGAAGACAATGTCTTCTACAATTTAAACGA 1380

D P F C F D V N T L L S N O L R L A F L G A S V T E D V K F A
Replicase 1a

GCTAGCACTGGTGTATTGACATTAGTGTGGTATGTTTGGTCTTTACGATGACATATTGACAAACAATAAACCTTGGTTTGTACGCAAAGC
CGATCGTGACCACAATAACTGTAATCACGACCATAACAACCAGAAATGCTACTGTATAACTGTTTGTATTGTTGGAACCAACATGCGTTTCG 1472

A S T G V I D I S A G M F G L Y D D I L T N N K P W F V R K A
Replicase 1a

TTCTGGGCTTTTTGATGCAATCTGGGATGCTTTTGTGGCGCTATTAAGCTTGTGCCAACTACTACTGGTGGTTTGGTTAGGTTTGTAAAGT
AAGACCCGAAAAACTACGTTAGACCCTACGAAAACAACGGCGATAATTGGAACACGGTTGATGATGACCACCAACCAATCCAAACAATTCA 1564

S G L F D A I W D A F V A A I K L V P T T T G G L V R F V K
Replicase 1a

CTATCGCTTCAACTGTTTTAACTGTTTCTAATGGTGTATTATTATGTGTGCAGATGTTCCAGATGCTTTTCAACCAGTTTACCGCACATTT
GATAGCGAAGTTGACAAAATTGACAAAGATTACCACAATAATAACACACGCTACAAGGTCTACGAAAAGTTGGTCAAATGGCGGTGTAAG 1656

S I A S T V L T V S N G V I I M C A D V P D A F O P V Y R T F
Replicase 1a

ACACAAGCTATTTGTGCTGCATTGATTTTCTTTAGATGATTTAAAATTGGTGATGTTAAATTTAAACGACTTGGTGATTATGTTCTTAC 1748
TGTGTTGATAAACACGACGTAACATAAAAGAAATCTACATAAATTTAACTACTACAATTTAAATTTGCTGAACCACTAATACAAGAATG
T Q A I C A A F D F S L D V F K I G D V K F K R L G D Y V L T
Replicase 1a

TGAAAATGCTCTTGTTCGTTTGACTACTGAAGTTGTTCTGTTGTTCTGATGCTCGCATAAAGAAAGCCATGTTTACTAAAGTAGTTGTAG 1840
ACTTTTACGAGAACAAGCAAACGATGACTTCAACAAGCACCACAAGCACTACGAGCGTATTTCTTTGCGGTACAAATGATTCATCAACATC
E N A L V R L T T E V V R G V R D A R I K K A M F T K V V V
Replicase 1a

GTCCTACAACGAAGTTAAGTTTCTGTTATTGAACCTGCCACTGTTAATTTGCGTCTTGTGATTGTGCACCTGTAGTTGCCCTAAAGGT 1932
CAGGATGTTGACTTCAATTCAAAGACAATAACTTGAACGGTGACAATTAAACGCAGAACAATAACACGTGGACATCAAACGGGATTTCCA
G P T T E V K F S V I E L A T V N L R L V D C A P V V C P K G
Replicase 1a

AAAATTGTTGTTATTGCTGGACAAGCTTTTTCTATAGTGGTGGTTTTATCGTTTTATGGTTGATTCTACAACGTATTAAATGACCCTGT 2024
TTTTAACACAATAACGACCTGTTGCAAAAAGATATCACCACCAAAAATAGCAAAATACCAACTAAGATGTTGACATAATTTACTGGGACA
K I V V I A G Q A F F Y S G G F Y R F M V D S T T V L N D P V
Replicase 1a

TTTTACTGGTGAGTTATTTTATACTATTAAGTTTAGTGGTTTTAAGCTTGATGGTTTTAACCATCAGTTTGTTAATGCTAGTTCTGCTACAG 2116
AAAATGACCACTCAATAAAATATGATAATTCAAATCACCAAAATTCGAACCTACCAAAATTTGGTAGTCAACAATTACGATCAAGACGATGTC
F T G E L F Y T I K F S G F K L D G F N H Q F V N A S S A T
Replicase 1a

ATGCCATTATTGCTGTTGAGCTGTTGTTATCGGATTTTAAACTGCAGTTTTTGTGTACACATGTGTGGTTGATGGTTGTAGTGTCAATTGTT 2208
TACGGTAATAACGACAACCTGACAACAATAGCCTAAAATTTGACGTCAAAAACACATGTGTACACACCACTACCAACATCACAGTAACAA
D A I I A V E L L L S D F K T A V F V Y T C V V D G C S V I V
Replicase 1a

AGACGTGATGCTACATTGCGCACACATGTGTGTTTTAAGGACTGTTATAGTATTTGGGAGCAATTCTGCATTGATAATTGTGGTGAGCCATG 2300
TCTGCACTACGATGTAAGCGGTGTGTACACACAAAATTCCTGACAATATCATAAACCCCTCGTTAAGACGTAACCTATTAACACCACTCGGTAC
R R D A T F A T H V C F K D C Y S I W E Q F C I D N C G E P W
Replicase 1a

GTTTTGACTGATTATAATGCTATCTTGCAGAGTAATAACCTCAATGTGCTATTGTTCAAGCATCGGAGTCTAAAGTTTTGCTTGAGAGGT 2392
CAAAAAGTACTAATATTACGATAGAACGTCTCATTATTGGGAGTTACACGATAACAAGTTCTGAGCCTCAGATTTCAAAACGAACCTCTCCA
F L T D Y N A I L O S N N P Q C A I V O A S E S K V L L E R
Replicase 1a

TTTTACCTAAGTGCTCTGAAACTGTTGAGTATTGATGATGGCCATTTATGGAATCTTTTTGTTGAAAAGTTTAATTTGTTACAGATTGG 2484
AAAATGGATTACAGGACTTTATGACAACCTATAACTACTACCGGTAAATACCTTAGAAAAACAACCTTTCAAATTTAAACAATGTCTAAC
F L P K C P E I L L S I D D G H L W N L F V E K F N F V T D W
Replicase 1a

TTAAAACTCTTAAGCTTACACTTACTTCTAATGGTCTTTTAGGTAATTGTGCCAAACGTTTTAGACGTGTTTTGGTAAAAATTGCTTGATGT
AATTTTGGAGAATTCGAATGTAATGAAGATTACCAGAAAAATCCATTAAACACGGTTTGCAAAATCTGCACAAAACGATTTTAACGAACCTACA 2576
L K T L K L T L T S N G L L G N C A K R F R R V L V K L L D V
Replicase 1a

CTATAATGGTTTTCTTGAACTGTCTGTAGTGCTGACACTGCTGGTGGTTTGCATTAAATATTATGCTGTTAATGTTCCATATGTAGTTA
GATATTACCAAAAAGAACTTTGACAGACATCACAGCATGTGTGACGACCACAAACGTAATTTATAATACGACAATTACAAGGTATACATCAAT 2668
Y N G F L E T V C S V V H T A G V C I K Y Y A V N V P Y V V
Replicase 1a

TTAGTGGTTTTGTAAGTCGTGTAATTCGTAGAGAAAGGTGTGACGTGACTTTTCTTGTGTTAGTTGTGTCACTTTTTTCTATGAATTTTTA
AATCACCAAAACATTGACACATTAAAGCATCTCTTCCACACTGCACTGAAAAGGAACACAATCAACACAGTGAAAAAGATACTTAAAAAT 2760
I S G F V S R V I R R E R C D V T F P C V S C V T F F Y E F L
Replicase 1a

GACACGTGTTTTGGTGTAGTAAACCTAATGCCATTGATGTTGAACATTAGAGCTTAAAGAACTGTTTTGTTGAACCTAAGGATGGTGG
CTGTGCACAAAACCAATCATTGGATTACGGTAACATACTGTAATCTCGAATTTCTTGACAAAAACAACCTGGATTCTTACCACC 2852
D T C F G V S K P N A I D V E H L E L K E T V F V E P K D G G
Replicase 1a

TCAATTTTTGTTTCTGATGATTATCTTTGGTATGTTGTAGATGACATTTATTATCCAGCTTCATGTAATGGTGTATTGCCAGTTGCTTTTA
AGTTAAAAACAAAGACTACTAATAGAAACCATAACATCTACTGTAATAATAGGTGGAAGTACATTACCACATAACGGTCAACGAAAAT 2944
Q F F V S D D Y L W Y V V D D I Y Y P A S C N G V L P V A F
Replicase 1a

CAAAATTGGCAGGTGGTAAATATCTTTTCTGATGATGTTATAGTTTCATGATGTTGAACCTACCCATAAGTCAAGCTCATATTTGAGTTT
GTTTAAACGTCCACCATTTTATAGAAAAAGACTACTACAATATCAAGTACTACAACCTGGATGGGTATTTTCAGTTGAGTATAAACTCAAA 3036
T K L A G G K I S F S D D V I V H D V E P T H K V K L I F E F
Replicase 1a

GAAGATGATGTTGTTACCACTCTTTGTAAGAAGAGTTTTGGTAACTCTATTATTTATACAGGTGATTGGGAAGGTTTACATGAAGTTCTTAC
CTTCTACTACAACAATGGTCAGAAACATTCTTCTCAAAACCATTCAGATAATAAATATGTCCACTAACCCCTTCAAATGTACTTCAAGAATG 3128
E D D V V T S L C K K S F G K S I I Y T G D W E G L H E V L T
Replicase 1a

ATCTGCAATGAATGTCATTGGGCAACATATTAAGTTGCCACAATTTATATTTATGATGAAGAGGGTGGTTATGATGTTTCTAAACCACTTA
TAGACGTTACTTACAGTAACCCGTTGTATAATTCAACGGTGTTAAATATAAATACTACTTCTCCCACTAATACTACAAAGATTTGGTCAAT 3220
S A M N V I G O H I K L P Q F Y I Y D E E G G Y D V S K P V
Replicase 1a

TGATTTCAATGGCCTATTAGTGATGATAGTGATGGTTGTGTTGTTGAAGCGAGCACTGATTTTCATCAATTAGAATCTGTTAGAGAAGAG
ACTAAAGTGTACCGGATAATCACTACTATCACTACCAACAACAACCTTCGCTCGTGACTAAAAGTAGTTAATCTTAGACAATCTCTTCTC 3312
M I S O W P I S D D S D G C V V E A S T D F H O L E S V R E E
Replicase 1a

GTGATATAATTGAACAACCTTTTGGGGAAGTTGAACATGCGCTCTCAATTAGACAACCTTTTCTTTTCTTTAGAGATGAATTGGGTGT 3404
CAACTATATTAACCTGTTGGAAAACCCCTTCAACTTGTACGCGAGAGTTAATCTGTTGGAAAAAGAAAAGAAATCTCTACTTAACCCACA
V D I I E Q P F G E V E H A L S I R O P F S F S F R D E L G V
Replicase 1a

TCGTGTTTGTAGTCAATCTGATAATAATTGTTGGATTAGTACCACACTTATACAGTTGCAACTTACAAAGCTTTTGGATGATTCTATTGAGA 3496
AGCACAAATCTAGTTAGACTATTATTAACAACCTAATCATGGTGTGAATATGTCAACGTTGAATGTTTCGAAAACCTACTAAGATAACTCT
R V L D Q S D N N C W I S T T L I Q L O L T K L L D D S I E
Replicase 1a

TGCAATTGTTTAAAGTTGGTAAAGTTGATTCAATTGTTCAAAAGTGTATGAGTTGTCTCATTTAATTAGTGGTTCACCTTGGTGATAGTGGT 3588
ACGTTAACAAATTTCAACCATTTCAACTAAGTTAACAAGTTTTCACAATACTCAACAGAGTAAATTAATCACCAAGTGAACCACTATCACCA
M Q L F K V G K V D S I V O K C Y E L S H L I S G S L G D S G
Replicase 1a

AAACTTCTTAGTGAACCTCTTAAAGATAAATATACATGTTCTATAACTTTTGAGATGTCTTGTGATTGTGGTAAAAAGTTTGATGAGCAAGT 3680
TTTGAAGAATCACTTGAAGAATTTCTATTTATATGTACAAGATATTGAAAACCTACAGAACCTAACACCATTTTCAAACCTACTCGTTCA
K L L S E L L K D K Y T C S I T F E M S C D C G K K F D E Q V
Replicase 1a

TGGTTGTTTGTGTTTGGATTATGCCTTACACAAAACCTTTTCAAAAAGGTGAGTGTGTTTGTATTTGTCATAAAATGCAGACTTATAAGCTTGTTA 3772
ACCAACAAACAAAACCTAATACGGAATGTGTTTGA AAAAGTTTTCACACTCACAACATAAACAGTATTTTACGCTGAATATTGGAACAAT
G C L F W I M P Y T K L F Q K G E C C I C H K M Q T Y K L V
Replicase 1a

GTATGAAAGGTACTGGTGTGTTTGTACAGGATCCAGCACCTATTGACATTGATGCTTTCCCTGTTAGACCTATATGTTTCATCTGTATATTTA 3864
CATACTTTCCATGACCACACAAACATGTCTTAGTGTGTTGATACTGTAACCTACGAAAGGGACAATCTGGATATACAAGTAGACATATAAAT
S M K G T G V F V Q D P A P I D I D A F P V R P I C S S V Y L
Replicase 1a

GGTGTTAAGGGTTCTGGTCATTATCAACAAATTTATACAGTTTGC AAAAGCTATTGATGGTTTTGGTGTCTTTGACATTAAAAATAGTAG 3956
CCACAATTTCCAAGACCAGTAATAGTTTGT TTAATATGTCAAAACTGTTTCGATAACTACAAAACCCAGAACTGTAATTTTATCATC
G V K G S G H Y Q T N L Y S F D K A I D G F G V F D I K N S S
Replicase 1a

TGTTAATACTGTTTGTGTTTGTGATGTTGATTTTCATAGTGTAGAAATAGAAGCTGGTGAAGTTAAACCTTTTGTGTATATAAAAATGTTA 4048
ACAATTATGACAAACAAACAACTACAACCTAAAAGTATCACATCTTTATCTTCGACCACTTCAATTTGGAAAACGACATATATTTTACAAT
V N T V C F V D V D F H S V E I E A G E V K P F A V Y K N V
Replicase 1a

AATTTTATTTAGGTGATATTTACACCTTGTAACCTGTGTTTCTTTGACTTTGTTGTCAATGCTGCTAATGAAAATCTCATGCATGGAGGC 4140
TTAAATAAATCCACTATAAAGTGTGGAACATTTGACACAAAGAAAACCTGAAACAACAGTTACGACGATTACTTTTAGAGTACGTACCTCCG
K F Y L G D I S H L V N C V S F D F V V N A A N E N L M H G G
Replicase 1a

GGTGTGCGACGTGCTATTGATATTTTGAAGGTCACCTTCAGTCATTATCTAAAGATTACATTAGTAGTAATGGTCCACTTAAGGTTGG 4232
CCACAGCGTGCACGATAACTATAAACTGACTTCCAGTTGAAGTCAGTAATAGATTTCTAATGTAATCATCATTACCAGGTGAATTCCAACC
G V A R A I D I L T E G O L O S L S K D Y I S S N G P L K V G
Replicase 1a

AGCAGGTGTTATGTTGGAGTGTGAAAAATTCAATGTATTTAATGTTGGTCCGCGAACTGGTAAACATGAGCATTCACTTGTGAAG 4324
TCGTCCACAATACAACCTCACACTTTTAAAGTTACATAAATTACAACAACCAGGCGCTTGACCATTGTACTCGTAAGTAATGAACAACCTTC
A G V M L E C E K F N V F N V V G P R T G K H E H S L L V E
Replicase 1a

CTTATAATTCTATTTTATTTGAAAATGGTATTCCACTTATGCCTCTTCTAGTTGTGGTATTTTGGTGAAGGATTGAAAATTCTCTTAAA 4416
GAATATTAAGATAAAATAAATTTTACCATAAGGTGAATACGGAGAAGAATCAACACCATAAAAACCATTCCTAATCTTTAAGAGAATTT
A Y N S I L F E N G I P L M P L L S C G I F G V R I E N S L K
Replicase 1a

GCTTTGTTTAGTTGTGACATTAATAAACCATTCGAAGTTTTGTTTATCTTCAATGAAGAACAAGCTGTTCTTAAGTTTTAGATGGTTT 4508
CGAAACAAATCAACACTGTAATTATTTGGTAACGTTCAAAAACAAATAAGAAGTTACTTCTTGTTCGACAAGAATTCAAAAATCTACAAA
A L F S C D I N K P L Q V F V Y S S N E E Q A V L K F L D G L
Replicase 1a

AGATTTAACACCAGTCATTGACGATGTTGATGTTGTTAAACCTTTTAGAGTTGAAGGTAATTTTTCATTCTTTGATTGTGGTGTCAATGCCT 4600
TCTAAATTGTGGTCAGTAACCTGCTACAACCTACAACAATTGGAAAATCTCAACTCCATTAAAAAGTAAGAACTAACACCACAGTTACGGA
D L T P V I D D V D V V K P F R V E G N F S F F D C G V N A
Replicase 1a

TGGATGGTGATATTTACTTATTATTTACTAACTCTATTTTAAATGTTGGATAAACAAGGACAATTATTGGACACAAACTTAATGGTATTTG 4692
ACCTACCACTATAAATGAATAATAAATGATTGAGATAAAATTACAACCTATTTGTTCTGTTAATAACCTGTGTTTTGAATTACCATAAAAC
L D G D I Y L L F T N S I L M L D K O G O L L D T K L N G I L
Replicase 1a

CAACAGGCAGTCTTGATTATCTTGCTACAGTTAAACTGTACCAGCTGGTAATTTGGTTAAACTTGTGTTGAGAGTTGTACCATTATAT 4784
GTTGTCCGTCAAGAACTAATAGAACGATGTCAATTTTGACATGGTCGACCATTAAACCAATTGAACAACAACCTCTCAACATGGTAAATATA
Q Q A V L D Y L A T V K T V P A G N L V K L V V E S C T I Y M
Replicase 1a

GTGTGTTGTACCATCGATAAATGATCTTTCTTTTGATAAAATCTTGGTCGTTGTGTGCGTAAACTTAATAGATTGAAAACCTGTGTTATTG 4876
CACACAACATGGTAGCTATTTACTAGAAAGAAAATCTTTTGAACAGCAACACACGCATTGGAATTATCTAATCTTTGAACACAATAAC
C V V P S I N D L S F D K N L G R C V R K L N R L K T C V I
Replicase 1a

CCAATGTTCTGCTATTGATGTTTTGAAAAGCTTCTTTCAAGTTGACTTTAACTGTTAAATTTGTTGTAGAGAGTAATGTTATGGATGTT 4968
GGTTACAAGGACGATAACTACAAAATTTTGAAGAAAGTTCAAACTGAAATTGACAATTTAAACAACATCTCTCATTACAATACCTACAA
A N V P A I D V L K K L L S S L T L T V K F V V E S N V M D V
Replicase 1a

AACGACTGTTTTAAGAATGATAATGTAGTTTGAATAATTACTGAAGATGGTATTAATGTTAAAGATGTTGTTGTTGAGTCTTCTAAGTCACT 5060
TTGCTGACAAAATCTTACTATTACATCAAACTTTAATGACTTCTACCATAATTACAATTTCTACAACAACAACCTCAGAAGATTCAAGTGA
N D C F K N D N V V L K I T E D G I N V K D V V V E S S K S L
Replicase 1a

TGGTAAACAATTGGGTGTTGTGAGTGATGGTGTGACTCTTTTGAAGGTGTTTACCTATTAATACTGATACTGTCTTATCTGTAGCTCCAG 5152
ACCATTTGTAAACCCACAACACTCACTACCACAACCTGAGAAAACCTCCACAAAATGGATAATTATGACTATGACAGAATAGACATCGAGGTC
G K Q L G V V S D G V D S F E G V L P I N T D T V L S V A P
Replicase 1a

AAGTTGACTGGGTGCTTTTTACGGTTTTGAAAAGGCAGCACTTTTGTCTTTGGATGTAAGCCATATGGTTACCCTAATGATTTTGT 5244
TTCAACTGACCCACGAAAATGCCAAAACCTTTCCGTCGTGAAAACGAAGAAACCTACATTTCCGTATACCAATGGGATTACTAAAACAA
E V D W V A F Y G F E K A A L F A S L D V K P Y G Y P N D F V
Replicase 1a

GGTGGTTTTAGAGTTCTTGGGACCACCGACAATAATTGTTGGGTAAATGCAACTTGTATAATTTACAGTATCTTAAGCCTACTTTTAAATC 5336
CCACCAAAATCTCAAGAACCCTGGTGGCTGTTATTAACAACCAATTACGTTGAACATATTAATATGTCATAGAATTCGGATGAAAATTTAG
G G F R V L G T T D N N C W V N A T C I I L O Y L K P T F K S
Replicase 1a

TAAGGGTTAAATGTTCTTTGGAACAAATTTGTTACAGGTGATGTTGGACCTTTTGTAGTJTATTTATTTTATAACTATGTCTTCAAAGG 5428
ATTCCCAAATTTACAAGAAACCTTGTTTAAACAATGTCCACTACAACCTGGAAAACAATCAAATAAAATAAATATTGATACAGAAGTTTC
K G L N V L W N K F V T G D V G P F V S F I Y F I T M S S K
Replicase 1a

GTCAAAGGGTGATGCTGAAGAGGCATTATCTAAATTGTCAGAGTATTTGATTAGTGATTCTATTGTTACTCTTGAACAATATTCAACTGT 5520
CAGTTTTCCCACTACGACTTCTCCGTAATAGATTTAACAGTCTCATAAACTAATCACTAAGATAACAATGAGAAGCTTGTATAAGTTGAACA
G O K G D A E E A L S K L S E Y L I S D S I V T L E O Y S T C
Replicase 1a

GACATTTGTAAGTACTGTAGTTGAAGTTAAAGTGCTGTTGTCTGTGCTAGTGTGCTTAAAGATGGTTGTGATGTTGGTTTTTGTCCACA 5612
CTGTAAACATTTTCATGACATCAACTTCAATTTTCACGACAACAGACAGATCACACGAATTTCTACCAACACTACAACCAAAAACAGGTGT
D I C K S T V V E V K S A V V C A S V L K D G C D V G F C P H
Replicase 1a

CAGACATAAATTGCGTTCACGTGTTAAGTTTGTAAATGGACGTGTTGTTATTACCAATGTTGGTGAACCTATAATTTACAACCTTCTAAGT 5704
GTCTGTATTTAACGCAAGTGACAATTCAAACAATTACCTGCACAACAATAATGGTTACAACCACTTGGATATTAAGTGTGGAAGATTCA
R H K L R S R V K F V N G R V V I T N V G E P I I S Q P S K
Replicase 1a

TGCTTAATGGTATTGCTTATACAACATTTTCAGGTTCTTTTGATAACGGTCACTATGTAGTTTATGATGCTGCTAATAATGCTGTCTATGAT 5796
ACGAATTACCATAACGAATATGTTGTAAAAGTCCAAGAAAACCTATTGCCAGTGATACATCAAATACTACGACGATTATTACGACAGATACTA
L L N G I A Y T T F S G S F D N G H Y V V Y D A A N N A V Y D
Replicase 1a

GGTGCTCGTTTATTTGCTTCAGATTGTCTACTTTAGCTGTTACAGCTATTGTTGTAGTAGGTGGTTGTGTAACATCTAATGTTCCACCAAT 5888
CCACGAGCAAATAAACGAAGTCTAAACAGATGAAATCGACAATGTCGATAACAACATCATCCACCAACACATTGTAGATTACAAGGTGGTTA
G A R L F A S D L S T L A V T A I V V V G G C V T S N V P P I
Replicase 1a

TGTTAGTGAGAAAATTTCTGTTATGGATAAACTTGATACTGGTGCACAAAAATTTTCCAATTTGGTGATTTTGTATGAATAACATTGTTT 5980
ACAATCACTCTTTTAAAGACAATACCTATTTGAACTATGACCACGTGTTTTTAAAAAGGTTAAACCACTAAAACAATACTTATTGTAACAAG
V S E K I S V M D K L D T G A Q K F F Q F G D F V M N N I V
Replicase 1a

TGTTTTAACTTGTTGCTTAGTATGTTTAGTCTTTTACGTACTTCTATTATGAAGCATGATATTAAAGTTATTGCCAAGGCTCCTAAACGT 6072
ACAAAAATTGAACCAACGAATCATACAAATCAGAAAATGCATGAAGATAATACCTTCGTACTATAATTTCAATAACGGTTCGGAGGATTGCA
L F L T W L L S M F S L L R T S I M K H D I K V I A K A P K R
Replicase 1a

ACAGGTGTTATTTTGACACGTAGTTTTAAGTATAACATTAGATCTGCTTTGTTTGTGTAAGCAGAAGTGGTGTGTTATTGTTACTTTGTT 6164
TGTCACAATAAACTGTGCATCAAATTCATATTGTAATCTAGACGAAACAACAACATTTCTGCTTCACCACACAATAACAATGAAACAA
T G V I L T R S F K Y N I R S A L F V V K Q K W C V I V T L F
Replicase 1a

TAAGTCTTATTGTTATTATATGCTATTTATGCACTTGTTTTATGATTGTGCAATTTAGTCTTTTAAATAGTCTTTTATGTGGTGACATTG 6256
ATTCAAGAATAACAATAATATACGATAAATACGTGAACAAAAATACTAACACGTTAAATCAGGAAAATTATCAGAAAATACACCACTGTAAC
K F L L L L Y A I Y A L V F M I V Q F S P F N S L L C G D I
Replicase 1a

TAAGTGGTTATGAAAAATCCACTTTTAAATAAGGATATTTATTGTGGTAATCTATGGTTTGTAAGATGTGTTTGTGTTAGTTATCAAGAGTTT 6348
ATTCACCAATACTTTTAGGTGAAAATTATTCCTATAAATAACACCATTAAGATACCAACATTCTACACAACAAATCAATAGTTCTCAAA
V S G Y E K S T F N K D I Y C G N S M V C K N C L F S Y Q E F
Replicase 1a

AATGATTTGGATCATACTAGTCTTGTGTTGGAAGCACATTGCTGATCCTATATTAATCAGTTTACAAACATTGTTATACTTGTATTTTGT 6440
TTACTAAACCTAGTATGATCAGAACAACCTTCGTGTAAGCACTAGGATATAATTAGTCAAATGTTGGTAAACAATATGAACAATAAAACAA
N D L D H T S L V W K H I R D P I L I S L Q P F V I L V I L L
Replicase 1a

AATTTTGGTAATATGATTTTGCCTTTTGGACTTTTATATTTTGTGCAAAATTTATTAGTACTTTTGGTTCTTTCTTAGGCTTTTCATCAGA 6532
TTAAAAACCATTTATACATAAACGCAAAACCTGAAAATATAAAACAACGTGTTAAATAATCATGAAAACCAAGAAAGAATCCGAAAGTAGTCT
I F G N M Y L R F G L L Y F V A Q F I S T F G S F L G F H Q
Replicase 1a

AACAGTGGTTTTACATTTTGTGCCGTTTGATGTTTTATGTAATGAGTTTTAGCTACATTTATTGTCTGCAAAATGTTTTATTTGTTAGA 6624
TTGTCACCAAAAATGTAAACACGGCAAACTACAAATACATTACTCAAAATCGATGTAATAACAGACGTTTTAACAAAATAAACAATCT
K Q W F L H F V P F D V L C N E F L A T F I V C K I V L F V R
Replicase 1a

CATATTATTGTTGGCTGTAATAATGCTGACTGTGTAGCTTGTCTCTAAAAGTCTAGACTTAAACGTGTACCACTTCAAACATTATTATAATGG
GTATAATAACAACCGACATTATTACGACTGACACATCGAACAAAGATTTTCACGATCTGAATTTGCACATGGTGAAGTTTGATAATAATTACC 6716

H I I V G C N N A D C V A C S K S A R L K' R V P L Q T I I N G
Replicase 1a

TATGCATAAATCATTCTATGTTAATGCTAATGGTGGTACTTGTCTCTGTAATAAACATAACTTCTTTTGTGTTAATTGTGATTCTTTTGGGC
ATACGTATTTAGTAAGATAACAATTACGATTACCACCATGAACAAAGACATTATTTGTATTGAAGAAAACACAATTAACACTAAGAAAACCCG 6808

M H K S F Y V N A N G G T C F C N K H N F F C V N C D S F G
Replicase 1a

CTGGTAATACTTTTATTAAATGGTGATATTGCAAGAGAGCTTGGTAATGTTGTTAAACAGCTGTTCAACCCACAGCTCCTGCATATGTTATT
GACCATTATGAAAATAATTACCACTATAACGTTCTCTCGAACCATTACAACAATTTGTGCGACAAGTTGGGTGTCGAGGACGTATACAATAA 6900

P G N T F I N G D I A R E L G N V V K T A V Q P T A P A Y V I
Replicase 1a

ATTGATAAGGTAGATTTTGTAAATGGATTTTATCGTCTTTATAGTGGTGACACTTTTTGGCGGTATGACTTTGACATTACTGAATCTAAGTA
TAACTATTCCATCTAAAACAATTACCTAAAATAGCAGAAATATCACCAGTGTGAAAAACCGCCATACTGAAACTGTAATGACTTAGATTCAT 6992

I D K V D F V N G F Y R L Y S G D T F W R Y D F D I T E S K Y
Replicase 1a

TAGTTGTAAGAGGTTCTGAAGAATTGTAATGTTTTAGAAAATTTATTGTTTACAATAATAGTGGTAGTAACATTACACAGATTAATAATG
ATCAACATTTCTCCAAGACTTCTTAACATTACAAAATCTTTTAAATAACAAATGTTATTATCACCATCATTGTAATGTGTCTAATTTTAC 7084

S C K E V L K N C N V L E N F I V Y N N S G S N I T Q I K N
Replicase 1a

CTTGTTTATTTTCTCAATTGTTGTGTGAACCTATAAAGTTGGTAAATTCAGAGTTGTTGTCAACTTTATCAGTTGATTTTAAATGGTGT
GAACACAAATAAAAAGAGTTAACAACACACTTGGATATTTCACCATTTAAGTCTCAACAACAGTTGAAATAGTCAACTAAAATTACCACAA 7176

A C V Y F S Q L L C E P I K L V N S E L L S T L S V D F N G V
Replicase 1a

TTGCATAAGGCATATGTTGATGTTTTGTGTAATAGTTTTTTAAGGAGCTAACTGCTAACATGTCCATGGCTGAATGTAAGCTACACTTGG
AACGTATTCCGTATACAACACATAACAAACACATTATCAAAAAATTCCTCGATTGACGATTGTACAGGTACCGACTTACATTTTCGATGTGAACC 7268

L H K A Y V D V L C N S F F K E L T A N M S M A E C K A T L G
Replicase 1a

TTTGACTGTTTCTGATGATGATTTTGTGTTTACGCTGTTGCCAATGCACATAGGTATGACGTTTTGCTTTTCAAGTTTGTCTTTAATAATTTT
AAACTGACAAAGACTACTACTAAAACAAAGTCGACAACGGTTACGTGTATCCATACTGCAAAACGAAAGTCTAAACAGTAAATTATTAATAA 7360

L T V S D D D F V S A V A N A H R Y D V L L S D L S F N N F
Replicase 1a

TTATTTCTTATGCTAAACCTGAAGATAAGTTGTCCGTTTATGACATTGCTTGTGATGCGTGCCGGTTCTAAGGTTGTTAACCATAATGTT
AATAAGAATACGATTTGGACTTCTATTCAACAGGCAAACTACTGTAAACGAACAACATACGCACGGCCAAGATTCCAACAATTGGTATTACAA 7452

F I S Y A K P E D K L S V Y D I A C C M R A G S K V V N H N V
Replicase 1a

TTAATCAAAGAGTCAATACCTATTGTTTGGGGTGTCAAGGACTTTAATACTCTTTCTCAAGAAGGTAAGAAGTACCTTGTTAAACAACATAA
AATTAGTTTCTCAGTTATGGATAACAAACCCACAGTTCCTGAAATTATGAGAAAGAGTTCTTCCATTCTTCATGGAACAATTTTGTGATT 7544
L I K E S I P I V W G V K D F N T L S Q E G K K Y L V K T T K
Replicase 1a

AGCAAAGGGTTTGACTTTTTTATTAACCTTTAATGATAACCAAGCAATTACACAAGTTCCTGCTACTAGTATAGTTGCAAAACAGGGTGCTG
TCGTTTCCAAACTGAAAAAATAATTGAAAATTACTATTGGTTCGTTAATGTGTTCAAGGACGATGATCATATCAACGTTTTGTCCCACGAC 7636
A K G L T F L L T F N D N Q A I T O V P A T S I V A K Q G A
Replicase 1a

GTTTTAAACGTACTTATAATTTTCTGTGGTATGTATGTTTATTGTTGTTCATTGTTTATTGGTGTCTCATTATTGATTATACAACCACT
CAAAATTTGCATGAATATTAAGACACCATACATACAATAAACAACACGTAACAAATAACCACAGAGTAAATACTAATATGTTGGTGA 7728
G F K R T Y N F L W Y V C L F V V A L F I G V S F I D Y T T T
Replicase 1a

GTAAGTAGCTTTCATGGTTATGATTTTAAGTACATTGAGAATGGTCAGTTGAAGGTGTTTGAAGCACCTTTACACTGTGTTGTAATGTTTT
CATTGATCGAAAGTACCAATACTAAATTCATGTAAGTCTTACCAGTCAACTTCCACAACTTCGTGGAATGTGACACAAGCATTACAAAA 7820
V T S F H G Y D F K Y I E N G O L K V F E A P L H C V R N V F
Replicase 1a

TGATAATTTAATCAATGGCATGAGGCTAAGTTTGGTGTGTTACTACTAATAGTGATAAATGCTCTATAGTTGTTGGTGTTCAGAGCGTA
ACTATTAATTAAGTTACCGTACTCCGATTCAAACCACAACAATGATGATTATCACTATTACAGGATATCAACAACCACAAAGTCTCGCAT 7912
D N F N Q W H E A K F G V V T T N S D K C P I V V G V S E R
Replicase 1a

TTAATGTTGTTCTGGTGTTCACAAATGTATATTTGGTAGGAAAGACTCTTGTGTTTACATTACAGGCTGCTTTTGAAACACAGGTGTT
AATTACAACAAGGACCACAAGGTTGTTTACATATAAACCATCTTTCTGAGAACAAAATGTAATGTCCGACGAAAACCTTTGTGTCCACAA 8004
I N V V P G V P T N V Y L V G K T L V F T L O A A F G N T G V
Replicase 1a

TGTTATGACTTTGATGGTGTACCCTAGTGATAAGTGTATTTTAACTCTGCTTGTACTAGGTTGGAAGGTTTGGGTGGTGACAATGTTTA
ACAATACTGAAACTACCACAATGGTGATCACTATTACATAAAAAATTAAGACGAACATGATCCAACCTTCCAAACCCACCACTGTTACAAT 8096
C Y D F D G V T T S D K C I F N S A C T R L E G L G G D N V Y
Replicase 1a

TTGTTACAACACTGATCTTATTGAAGGTTCTAAACCTTATAGTATTTTACAGCCCAATGCTTATTATAAGTATGATGTTAAAAATTATGTAC
ACAATGTTGTGACTAGAATAACTTCCAAGATTGGAATATCATAAAATGTCGGGTACGAATAATTCATACTACAATTTTAAATACATG 8188
C Y N T D L I E G S K P Y S I L O P N A Y Y K Y D V K N Y V
Replicase 1a

GTTTTCCAGAAATTTAGCTAGAGGTTTGGCTTACGTACTATTAGAAGTTTGGCTACACGTTATTGTAGAGTTGGTGAATGCCGTGACTCA
CAAAAGGTCTTTAAATCGATCTCCAAACCGAATGCATGATAATCTTGAACCGATGTGCAATAACATCTCAACCACTTACGGCACTGAGT 8280
R F P E I L A R G F G L R T I R T L A T R Y C R V G E C R D S
Replicase 1a

CATAAAGGTGTTTGGTTTGGTTTGGATAAAATGGTATGTTAATGATGACGGTTACATTTGTGGTGATGGTCTTATAGACCT 8372
GTATTTCCACAAACAAACCAAACTATTTACCATACAATTACTACCTGCACAACTACTGCCAATGTAACACCACTACCAGAATATCTGGA
H K G V C F G F D K W Y V N D G R V D D G Y I C G D G L I D L
Replicase 1a
TCTTGTAATGTA CTCTCAATCTTTAGTTCATCTTTAGCGTTGTGGCTATGCTGGACATATGTTGTTTAAATTTCTTTTTCGACGATTTA 8464
AGAACAATTACATGAGAGTTAGAAATCAAGTAGAAAATCGCAACACCGATACAGACCTGTATACAACAAATTAAGAAAAACGTCGTAAT
L V N V L S I F S S S F S V V A M S G H M L F N F L F A A F
Replicase 1a
TTACATTTTGTGCTTTTACTAAATTTAAACGTGTTTTTGGTGATCTTTCTTATGGTGTGTTTACTGTTGTTTGTGCAACTTTGATT 8556
AATGTAACAAACACGAAAAATCAATGATTTAAATTTGCACAAAAACCACTAGAAAGAATACCACAAAAATGACAACAAACACGTTGAACTAA
I T F L C F L V T K F K R V F G D L S Y G V F T V V C A T L I
Replicase 1a
AATAACATTTCTTATGTTGTTACTCAAATTTATTTTTATGTTGCTTTATGCTATTTTGTATTTGTTTTACTAGGACAGTGCGTTATGC 8648
TTATTGTAAGAATACAACAATGAGTTTTAAATAAAAAATACAACGAAATACGATAAAACATAAAACAAAAATGATCCTGTCACGCAATACG
N N I S Y V V T Q N L F F M L L Y A I L Y F V F T R T V R Y A
Replicase 1a
TTGGATTTGGCATATTGCATACATTGTTGCATCTTCTGTTAATACCATGGTGCTTCTCACATGGTTTAGTTTTGCTGCATTTTATAGC 8740
AACCTAAACCGTATAACGTATGTAACAACGTATGAAGAACAATTATGGTACCACGAAGAGTGTAACCAATCAAACGACGTAAAAATCTCG
W I W H I A Y I V A Y F L L I P W W L L T W F S F A A F L E
Replicase 1a
TTTTACCTAATGTTTTTAAGTTAAAAATCTCTACTCAATTGTTTGAAGGTGATAAGTTTATAGGTACTTTTGAGAGTGCTGCTGCAGGTACA 8832
AAAAATGGATTACAAAAATTCATTTTTAGAGATGAGTTAACAACCTTCCACTATTCAAATATCCATGAAAACCTCTCAGCAGCAGCTCCATGT
L L P N V F K L K I S T O L F E G D K F I G T F E S A A A G T
Replicase 1a
TTTGTCTTGACATGCGTTCTTATGAAAGGCTGATAAATACTATTTACCTGAGAACTTAAGAATTATGCTGCAAGTTATAATAATATAA 8924
AAACAAGAACTGTACGCAAGAATACTTTCCGACTATTTATGATAAAGTGGACTCTTTGAATTCTTAATACGACGTTCAATATTATTTATATT
F V L D M R S Y E R L I N T I S P E K L K N Y A A S Y N K Y K
Replicase 1a
ATATTATAGTGGTAGTCTAGTGAGGCTGATTATCGTTGTGCTTGTGTTATGCTCATTTAGCCAAGGCTATGTTAGATTACGCAAAAGATCATA 9016
TATAATATCACCATCAGCATCACTCCGACTAATAGCAACACGAACAATACGAGTAAATCGGTTCCGATACAATCTAATGCGTTTTCTAGTAT
Y Y S G S A S E A D Y R C A C Y A H L A K A M L D Y A K D H
Replicase 1a
ATGACATGTTATATTCTCCACCTACCATTAGCTACAATTCACCTTACAATCTGGTCTTAAGAAGATGGCACAACCATCTGGTTGTGTTGAG 9108
TACTGTACAATATAAGAGGTGGATGGTAATCGATGTTAAGGTGGAATGTTAGACCAGAATCTCTTACCCTGTTGGTAGACCAACACAACCTC
N D M L Y S P P T I S Y N S T L O S G L K K M A O P S G C V E
Replicase 1a

AGATGTGTGGTTTCGGTCTGTTATGGTAGTACTGTGCTTAATGGAGTTTGGTTAGGTGACACTGTTACTTGTCTAGACATGTCATAGCACC 9200
TCTACACACCAAGCGCAGACAATACCATCATGACACGAATTACCTCAAACCAATCCACTGTGACAATGAACAGGATCTGTACAGTATCGTGG
R C V V R V C Y G S T V L N G V W L G D T V T C P R H V I A P
Replicase 1a

ATCAACCACTGTTCTTATTGATTATGATCATGCATATAGTACTATGCGTTTGATAATTTTTAGTGTCTCATAATGGTGTCTTCTTGGGAG 9292
TAGTTGGTGACAAGAATAACTAATACTAGTACGTATATCATGATACGCAACGTATTAAAAAGTCACAGAGTATTACCACAGAAGAACCTC
S T T V L I D Y D H A Y S T M R L H N F S V S H N G V F L G
Replicase 1a

TTGTTGGTGTACAAATGCATGGTTCTGTGTGCGTATTAAGGTTTACAATCTAATGTACATACCTAAACATGTTTTTAAACGTTGAAA 9384
AACAAACCAATGTTACGTACCAAGACACAACGCATAATCCAAAGTGTTAGATTACATGTATGTGGATTGTACAAAAATTTGCAACTTT
V V G V T M H G S V L R I K V S O S N V H T P K H V F K T L K
Replicase 1a

CCTGGTGCTTCTTTAATATTTTAGCATGTTATGAAGGTATTGCATCTGGTGTGTTTGGTGTAAATTTACGTACAACTTTACTATTAAAGG 9476
GGACCACGAAGAAAATTATAAATCGTACAATACTCCATAACGTAGACCACAAAAACCAATTAATGCATGTTTGAATGATAATTTCC
P G A S F N I L A C Y E G I A S G V F G V N L R T N F T I K G
Replicase 1a

TTCTTTTATAAATGGAGCTTGTGGTTCTCCTGGTTATAATGTTAGAAATGATGGTACTGTTGAGTTTTGTTATTTACACCAAATGAGTTAG 9568
AAGAAAATATTTACCTCGAACCAAGAGGACCAATATTACAATCTTTACTACCATGACAACCTCAAAACAATAAATGTGGTTTAACTCAATC
S F I N G A C G S P G Y N V R N D G T V E F C Y L H Q I E L
Replicase 1a

GTAGTGGTGCTCATGTTGGTTCTGATTTTACTGGTAGTGTATGTTAATTTTGATGACCAACCTAGTTTGCAAGTTGAGAGTGCCAACCTT 9660
CATCACCAGGAGTACAACCAAGACTAAAATGACCATCACAATACCATTAAACTACTGGTTGGATCAACGTTCAACTCTCAGGTTGGAA
G S G A H V G S D F T G S V Y G N F D D O P S L Q V E S A N L
Replicase 1a

ATGCTATCAGATAATGTTGTTGCCTTTTTGTATGCTGCTTTGTTGAATGGTTGTAGGTGGTGGTTCGTTCAACTAGAGTTAATGTTGATGG 9752
TACGATAGTCTATTACAACAACGGAAAAACATACGACGAAACAACCTACCAACATCCACCACCAACGCAAGTTGATCTCAATTACAACCTACC
M L S D N V V A F L Y A A L L N G C R W W L R S T R V N V D G
Replicase 1a

TTTTAATGAATGGGCTATGGCTAATGGTTATACAATGTTTCTAGTGTGAGTGCTATTCTATTTTGGCAGCAAAAACTGGTGTAGTGTG 9844
AAAATTACTTACCGATACCGATTACCAATATGTTAACAAGATCACAACCTACGATAAGATAAAACCGTCGTTTTTGACCACAATCACAAC
F N E W A M A N G Y T I V S S V E C Y S I L A A K T G V S V
Replicase 1a

AACAATTGTTAGCTTCCATTCAACATCTTCATGAAGGTTTTGGTGGTAAAAACATACTTGGTTATTCTAGTTTATGTGATGAGTTCACACTA 9936
TTGTTAACAATCGAAGGTAAGTTGTAGAAGTACTTCCAAAACCACTTTTGTATGAACCAATAAGATCAAATACACTACTCAAGTGTGAT
E O L L A S I O H L H E G F G G K N I L G Y S S L C D E F T L
Replicase 1a

GCTGAAGTTGTGAAGCAGATGTATGGTGTAACTTGCAAAGTGGTAAGGTTATTTTTGGTTTAAAAACAATGTTTTATTTAGCGTTTTCTT 10028
CGACTTCAACACTTCGTCTACATACCACAATTGAACGTTTCACCATTCCAATAAAAAACCAATTTTGTGTACAAAAATAATCGCAAAAGAA
A E V V K Q M Y G V N L Q S G K V I F G L K T M F L F S V F F
Replicase 1a

CACAATGTTTTGGGCAGAACTCTTTATTTATACAAACACTATATGGATAAACCTGTTATACTTACACCTATATTTGTTTACTTTTGTTT 10120
GTGTTACAAAACCGTCTTGAGAAATAAATATGTTTGTGATATACCTATTTGGGACAATATGAATGTGGATATAAAACAAATGAAAACAAA
T M F W A E L F I Y T N T I W I N P V I L T P I F C L L L F
Replicase 1a

TGTCATTAGTTTAACTATGTTTCTTAAACATAAGTTTTGTTTTGCAAGTATTTTTATTACCTACTGTTATTGCAACTGCTTTATATAAT 10212
ACAGTAATCAAAATTGATACAAAGAATTTGTATTCAAAAACAAAACGTTTCATAAAATAATGGATGACAATAACGTTGACGAAATATATTA
L S L V L T M F L K H K F L F L Q V F L L P T V I A T A L Y N
Replicase 1a

TGTGTTTTGGATTATTACATAGTAAAATTTTTGGCTGACCATTTTAACTATAATGTTTCAGTATTACAAATGGATGTTTCAGGGTTTAGTTAA 10304
ACACAAAACCTAATAATGTATCATTTTAAAAACCGACTGGTAAATGATATTACAAAGTCATAATGTTTACCTACAAGTCCCAAATCAATT
C V L D Y Y I V K F L A D H F N Y N V S V L Q M D V Q G L V N
Replicase 1a

IGTTTTGGTCTGTTTATTTGTTGTATTTTACACACATGGCGTTTTTCTAAAGAACGTTTCACACATTGGTTTACATATGTGTGTTCTCTTA 10396
ACAAAACCAGACAAATAAACACATAAAAATGTGTGTACCGCAAAAAGATTTCTTGCAAAGTGTGTAACCAATGTATACACACAAGAGAAT
V L V C L F V V F L H T W R F S K E R F T H W F T Y V C S L
Replicase 1a

TAGCAGTTGCTTACACTTATTTTTATAGTGGTGACTTTTTGAGTTTGCTTGTATGTTTTATGTGCTATATCTAGTGATTGGTACATTGGT 10488
ATCGTCAACGAATGTGAATAAAATATCACCCTGAAAACTCAAACGAACAATACAAAATACACGATATAGTACTAACCATGTAACCA
I A V A Y T Y F Y S G D F L S L L V M F L C A I S S D W Y I G
Replicase 1a

GCCATTGTTTTAGGTTGTCACGTTTGATTATATTTTTTTCACCTGAAAGTGTATTTAGTGTTTTTGGTGATGTGAAACTCACTTTAGTTGT 10580
CGGTAACAAAATCCAACAGTGCAAACTAATATAAAAAAGTGGACTTTCATAAATCACAAAACCACTACCTTTGAGTGAAATCAACA
A I V F R L S R L I I F F S P E S V F S V F G D V K L T L V V
Replicase 1a

TTATTTAATTTGTGGTTATTTAGTTTGTACTTATTGGGGCATTTTGTATTGGTTCAATAGGTTTTTAAATGTACTATGGGTGTTTATGATT 10672
AATAAATTAACACCAATAAATCAACATGAATAACCCCGTAAACATAACCAAGTTATCCAAAAATTTACATGATACCCACAAATACTAA
Y L I C G Y L V C T Y W G I L Y W F N R F F K C T H G V Y D
Replicase 1a

TTAAGGTGAGTGCTGCTGAATTTAAATACATGGTTGCTAATGGACTTTCATGCACCATATGGACCTTTTGATGCACTTTGGTTATCATTCAAA 10764
AATTCCACTCAGCAGACTTAAATTTATGTACCAACGATTACCTGAAGTACGTGGTATACCTGGAAAACCTACGTGAAACCAATAGTAAGTTT
F K V S A A E F K Y M V A N G L H A P Y G P F D A L W L S F K
Replicase 1a

TTACTTGGTATTGGTGGTGACCGTTGTATAAAAAATTTCAACTGTCCAATCCAACTGACTGATTGAAGTGACTAATGTTGTGTTATTGGG
AATGAACCATAACCACCACTGGCAACATATTTTAAAGTTGACAGGTTAGGTTTGACTGACTAACTTCACATGATTACAACAATAACCC 10856

L L G I G G D R C I K I S T V Q S K L T D L K C T N V V L L G
Replicase 1a

TTGTTTGTCTAGTATGAACATTGCAGCTAATTCTAGTGAATGGGCTTATTGTGTTGATTACACAATAAGATTAATCTTTGTGATGACCCAG
AACAAACAGATCATACTTGTAACTGCGATTAAGATCACTTACCCGAATAACACAATAAATGTGTTATTCTAATTAGAAACACTACTGGGTC 10948

C L S S M N I A A N S S E W A Y C V D L H N K I N L C D D P
Replicase 1a

AAAAAGCTCAAGGTATGTTGTTAGCACTCCTTGCGTTCTTTCTAAGTAAACATAGTGATTTTGGTCTTGATGGCCTTATTGATTCTTATTTT
TTTTTCGAGTTCATACAACAATCGTGAGGAACGCAAGAAAGATTCAATTGTATCACTAAAACCAGAACTACCGGAATAACTAAGAATAAAA 11040

E K A Q G M L L A L L A F F L S K H S D F G L D G L I D S Y F
Replicase 1a

GATAATAGTAGCACCTGCAGAGTGTGCTTCATCATTGTTAGTATGCCATCATATATTGCTTATGAAAATGCTAGACAAGCTTATGAGGA
CTATTATCATCGTGGGACGTCTCACAACGAAGTAGTAAACAATCATACGGTAGTATATAACGAATACTTTTACGATCTGTTCGAATACTCCT 11132

D N S S T L Q S V A S S F V S M P S Y I A Y E N A R O A Y E D
Replicase 1a

TGCTATTGCTAATGGATCTTCTCTCACTTATTAAACAATTGAAGCGTGCCATGAATATCGCAAAGTCTGAATTTGATCATGAGATATCTG
ACGATAACGATTACCTAGAAGAAGAGTTGAATAATTTGTTAACTTCGCACGGTACTTATAGCGTTTCAGACTTAAACTAGTACTCTATAGAC 11224

A I A N G S S S O L I K O L K R A M N I A K S E F D H E I S
Replicase 1a

TTCAGAAGAAAATTAATAGAATGGCTGAACAAGCTGCTACTCAGATGTATAAGAAGCACGCTCTGTTAATAGAAAATCTAAAGTTATTAGT
AAGTCTTCTTTAATTATCTTACCGACTTGTTCGACGATGAGTCTACATATTTCTTCGTGCGAGACAATTATCTTTAGATTTCATAATCA 11316

V Q K K I N R M A E Q A A T Q M Y K E A R S V N R K S K V I S
Replicase 1a

GCTATGCACTCTTACTTTTTGGAATGTTAAGACGTTTGGATATGTCTAGTGTGAACTGTTTTGAATTTAGCACGTGATGGTGTGTTGCC
CGATACGTGAGAAATGAAAAACCTTACAACTTGCAACCTATACAGATCACAACCTTGACAAAACCTAAATCGTGCCTACCACAACACGG 11408

A M H S L L F G M L R R L D M S S V E T V L N L A R D G V V P
Replicase 1a

ATTGTCAGTTATACCTGCAACTTCAGCTTCCAACTAATCTATTGTTAGTCCAGATCTTGAATCTTATTCTAAGATTGTTTGTGATGGTTCTG
TAACAGTCAATATGGACGTTGAAGTGAAGGTTTGATTGATAACAATCAGGTCTAGAAGTCTAGAATAAGATTCTAACAAACACTACCAAGAC 11500

L S V I P A T S A S K L T I V S P D L E S Y S K I V C D G S
Replicase 1a

TTCATTATGCTGGAGTTGTTTGGACACTTAATGATGTTAAAGACAATGATGGTAGACCTGTTTCATGTTAAAGAGATTACAAGGGAGAATGTT
AAGTAATACGACCTCAACAAACCTGTGAATTACTACAATTTCTGTTACTACCATCTGGACAAGTACAATTTCTCTAATGTTCCCTCTTACAA 11592

V H Y A G V V W T L N D V K D N D G R P V H V K E I T R E N V
Replicase 1a

GAAACTTTGACATGGCCTCTTATCCTTAATTGTGAACGTGTTGTTAACTTCAAAATAATGAAATTATGCCTGGTAACTTAAGCAAAAACC 11684
CTTTGAAACTGTACCGGAGAATAGGAATTAACACTTGCACAACAATTGAAGTTTTATTACTTTAATACGGACCATTGTAATTCGTTTTGG
E T L T W P L I L N C E R V V K L Q N N E I M P G K L K Q K P
Replicase 1a

TATGAAAGCTGAGGGTGATGGTGGTGGTTTTAGGTGATGGTAATGCTTTGTATAACTGAGGGTGGTAAAACCTTTATGTATGCTTATATT 11776
ATACTTTCGACTCCCACTACCACCACAAAATCCACTACCATTACGAAACATATTATGACTCCCACTTTTGAAAATACATACGAATATAAA
M K A E G D G G V L G D G N A L Y N T E G G K T F M Y A Y I
Replicase 1a

CTAATAAGCTGACCTTAAATTTGTTAAGTGGGAGTATGAGGGTGGTTGCAACACAATCGAGTTAGACTCTCCTTGTCGATTTATGGTCGAA 11868
GATTATTTGACTGGAATTTAAACAATTCACCTCATACTCCCAACAGTTGTGTTAGCTCAATCTGAGAGGAACAGCTAAATACCAGCTT
S N K A D L K F V K W E Y E G G C N T I E L D S P C R F M V E
Replicase 1a

ACACCTAATGGTCTCAAGTGAAGTATTTGTATTTTGTAAATAATTAATACCTACGTAGAGGTGCCGTTCTTGGTTTTATAGGTGCCAC 11960
TGTGGATTACCAGGAGTTCACTTCATAAACATAAAACAATTTTAAATTTATGGAATGCATCTCCACGGCAAGAACCAAAATATCCACGGTG
T P N G P Q V K Y L Y F V K N L N T L R R G A V L G F I G A T
Replicase 1a

AATTCGTCTACAAGCTGGTAAACAACTGAATTGGCTGTTAATCTGGACTTTTAACTGCTTGTGCTTTTTCTGTTGATCCAGCAACCACTT 12052
TTAAGCAGATGTTTCGACCAATTGTTTGACTTAACCGACAATTAAGACCTGAAAATTGACGAACACGAAAAGACAACCTAGGTCGTTGGTGAA
I R L Q A G K Q T E L A V N S G L L T A C A F S V D P A T T
Replicase 1a

ACTTGAAGCTGTTAAACATGGTGCAAAACCTGTAAGTAATTGTATTAAGATGTTATCTAATGGTGCTGGTAATGGTCAAGCTATAACAACT 12144
TGAACCTTCGACAATTTGTACCAGTTTTGGACATTCATTAACATAATTCTACAATAGATTACCACGACCATTACCAGTTCGATATTGTTGA
Y L E A V K H G A K P V S N C I K M L S N G A G N G Q A I T T
Replicase 1a

AGTGTAGATGCTAACCAATCAAGATTCTTATGGTGGAGCGTCTATTTGTTTGTATTGTCGGGCCACGTTCTCACCCTAGTATGGATGG 12236
TCACATCTACGATTGTGGTTAGTTCTAAGAATACCACCTCGCAGATAAACAAACATAACAGCCCGGGTGAAGGAGTGGGATCATACCTACC
S V D A N T N Q D S Y G G A S I C L Y C R A H V P H P S M D G
Replicase 1a

TTACTGTAAGTTTAAGGGTAAATGTGTTTCAGGTTCTATTGGTTGTTGGATCCTATTAGGTTTTGTTTAGAAAATAATGTGTGTAATGTTT 12328
AATGACATTCAAATTCCTTTACACAAGTCCAAGGATAACCAACAACTAGGATAATCCAAAACAAATCTTTTATTACACACATTACAAA
Y C K F K G K C V Q V P I G C L D P I R F C L E N N V C N V
Replicase 1a

GTGGTTGTTGGTTGGGACACGGGTGTGCTTGTGATCGTACAACCATTCAAAGTGTGACATTTCTTATTTAAACGAGCAAGGGGTTCTAGTG 12420
CACCAACAACCAACCCTGTGCCACACGAACACTAGCATGTTGGTAAGTTTCACAACTGTAAAGAATAAATTTGCTCGTTCCTCCCAAGATCAC
C G C W L G H G C A C D R T T I O S V D I S Y L N E O G V L V
Replicase 1a
R A R G S S
Replicase 1b

CAGCTCGACTAGAACCCCTGTAATGGCACGGACATCGATAAGTGTGCTTTTGACATTTATAATAAAATGTTTCATTCTTGGGTAAG 12512
GTCGAGCTGATCTTGGGACATTACCGTGCTGTAGCTATTCACACAAGCAGAAACTGTAAATATTATTTTACAAAGTAAGAACCATTTC
O L D
-Replicase 1a-
A A R L E P C N G T D I D K C V R A F D I Y N K N V S F L G K
Replicase 1b

TGTTTGAAGATGAACGTGTTTCGTTTTAAAAATGCTGATCTTAAGGATGGTTATTTTGTATAAAGAGGTGTACTAAGTCGGTTATGGAACA 12604
ACAACTTCTACTTGACACAAGCAAAATTTTACGACTAGAATTCCTACCAATAAAACAATATTTCTCCACATGATTTCAGCCAATACCTTGT
C L K M N C V R F K N A D L K D G Y F V I K R C T K S V M E H
Replicase 1b

CGAGCAATCCATGTATAACCTACTTAACTTTTCTGGTGCTTTGGCTGAGCATGATTTCTTTACTTGGAAGATGGCAGAGTCATTTATGGTA 12696
GCTCGTTAGGTACATATTGGATGAATTGAAAAGACCACGAAACCGACTCGTACTAAAGAAATGAACCTTTCTACCGTCTCAGTAAATACCAT
E O S M Y N L L N F S G A L A E H D F F T W K D G R V I Y G
Replicase 1b

ATGTTAGTAGACATAATCTTACTAAATATACTATGATGGACTTGGTTTATGCTATGCGTAACCTTTGATGAACAAAATTGTGATGTTCTAAAA 12788
TACAATCATCTGTATTAGAATGATTTATATGATACTACCTGAACCAATACGATACGCATTGAAACTACTTGTTTTAACTACAAGATTTT
N V S R H N L T K Y T M M D L V Y A H R N F D E Q N C D V L K
Replicase 1b

GAAGTATTAGTTTTAACTGGTTGTTGTGACAATTCTTATTTTGATAGTAAAGGGTTGGTATGACCCAGTTGAAAATGAAGATATACATAGAGT 12880
CTTCATAATCAAAATTGACCAACAACACTGTTAAGAATAAACTATCATTCCTCAACCACTACTGGGTCAACTTTTACTTCTATATGTATCTCA
E V L V L T G C C D N S Y F D S K G W Y D P V E N E D I H R V
Replicase 1b

TTATGCATCTCTTGGCAAAATTGTAGCTAGAGCTATGCTTAAATGCGTTGCTCTATGTGATGCGATGGTTGCTAAAGGTGTTGTTGGTGTTT 12972
AATACGTAGAGAACCGTTTTAACATCGATCTCGATACGAATTTACGCAACGAGATACACTACGCTACCAACGATTTCCACAACAACCACAAA
Y A S L G K I V A R A M L K C V A L C D A M V A K G V V G V
Replicase 1b

TAACATTAGATAACCAAGATCTTAATGGTAACTTTTATGATTTTGGTGATTTTGTGTTAGCTTACCTAATATGGGTGTTCCCTGTTGTACA 13064
ATTGTAATCTATTGGTTCTAGAATTACCATGAAAATACTAAACCCTAAACAACAATCGAATGGATTATCCCAAGGGACAACATGT
L T L D N O D L N G N F Y D F G D F V V S L P N M G V P C C T
Replicase 1b

TCATATTATTCTTATATGATGCCTATTATGGGTTTAACTAATTGTTTAGCTAGTGAGTGTTTTGTCAAGAGTGATATTTTTGGTAGTGATT
AGTATAATAAGAATATACTACGGATAATACCCAAATTGATTAACAAATCGATCACTCACAAACAGTTCTCACTATAAAAACCATCACTAAA 13156

S Y Y S Y M M P I M G L T N C L A S E C F V K S D I F G S D F
Replicase 1b

TAAACTTTTGATTGCTTAAGTATGATTTCACTGAACATAAGAAAAATTTATTCAATAAGTACTTTAAGCATTGGAGTTTTGATTATCATC
ATTTTGAAAACATAACGAATTCATACTAAAGTGACTTGTATTTCTTTAAATAAGTTATTCATGAAATTCGTAACTCAAACTAATAGTAG 13248

K T F D L L K Y D F T E H K E N L F N K Y F K H W S F D Y H
Replicase 1b

CTAATTGTAGTGACTGTTATGATGATATGTGTGTTATACATTGTGCTAATTTAATACACTATTTGCCACAACATACCAGGTACTGCTTTT
GATTAACATCACTGACAATACTACTATACACACAATATGTAACACGATTAAATTTATGTGATAAACGGTGTTGATATGGTCCATGACGAAAA 13340

P N C S D C Y D D M C V I H C A N F N T L F A T T I P G T A F
Replicase 1b

GGTCCACTATGTCGTAAAGTTTTATAGATGGTGTTCCACTTGTTACAACCTGCTGGTTATCATTTTTAAGCAATTAGGTTTGGTTTGAATAA
CCAGGTGATACAGCATTTCAAAAATATCTACCACAAGGTGAACAATGTTGACGACCAATAGTAAATTCGTTAATCCAAACCAACCTTATT 13432

G P L C R K V F I D G V P L V T T A G Y H F K Q L G L V W N K
Replicase 1b

AGATGTTAACACACACTCAGTTAGTTGACAATCACTGAACTTTTGCAATTTGTTACTGACCCTTCCTTGATAATAGCTTCTTCTCCAGCAC
TCTACAATTGTGTGTGAGTCAATCCAACCTGTAGTGACTTGAAAACGTTAAACAATGACTGGGAAGGAACATTATCGAAGAAGAGGTCTGTG 13524

D V N T H S V R L T I T E L L O F V T D P S L I I A S S P A
Replicase 1b

TCGTTGATCAACGCACTATTTGTTTTCTGTTGCAGCATTGAGTACTGGTTTGACAAATCAAGTTGTTAAGCCAGGTCATTTTAATGAAGAG
AGCAACTAGTTGCGTGATAAACAAGACAACGTCGTAACCTCATGACCAACTGTTAGTTCAACAATTCGGTCCAGTAAATTAATCTCTC 13616

L V D O R T I C F S V A A L S T G L T N O V V K P G H F N E E
Replicase 1b

TTTTATACTTTCTTCGTTTAAGAGGTTTCTTTGATGAAGTTCTGAACCTTACATTAACATTTCTTCTTCGCACAGAATGGTGATGCTGC
AAAATATTGAAAGAAGCAAATTCCTCAAAGAACTACTTCCAAGACTTGAATGTAATTTGTAAAGAAGAAGCGTGCTTACCACTACGACG 13708

F Y N F L R L R G F F D E G S E L T L K H F F A O N G D A A
Replicase 1b

TGTTAAAGATTTTGACTTTTACCGTTATAATAAGCCTACCATTTAGATATTTGTCAAGCTAGAGTTACATATAAGATAGTCTCTCGTTATT
ACAATTTCTAAACTGAAAATGGCAATATTATTCGGATGGTAAATCTATAACAGTTGATCTCAATGTATATTCTATCAGAGAGCAATAA 13800

V K D F D F Y R Y N K P T I L D I C Q A R V T Y K I V S R Y
Replicase 1b

TTGACATTTATGAAGGTGGCTGTATTAAGGCATGTGAAGTTGTTGTAACAAATCTTAATAAGAGTGCTGGTTGGCCATTAAATAAGTTTGGT
AACTGTAATACTTCCACCGACATAATTCCGTACACTTCAACAACATTGTTTAGAATTATTCTCACGACCAACCGGTAATTTATTCAAACCA 13892

F D I Y E G G C I K A C E V V V T N L N K S A G W P L N K F G
Replicase 1b

AAAGCTAGTTTGTATTACGAATCTATATCTTATGAAGAACAGGATGCTTTGTTTGCTTTGACAAAGCGTAATGCTCCTCCTACTATGACACA 13984
TTTCGATCAAACATAATGCTTAGATATAGAATACTTCTTGCTCTACGAAACAAACGAAACTGTTTCGCATTACAGGAGGGATGATACTGTGT
K A S L Y Y E S I S Y E E O D A L F A L T K R N V L P T M T O
Replicase 1b

GCTGAATCTTAAGTATGCTATTAGTGGTAAAGAACGCTGCTAGAACTGTTGGTGGTGTCTCTGTTGTCCACAATGACCACAAGACAATACC 14076
CGACTTAGAATTCATACGATAATCACCATTCTTGACGATCTTGACAACCACCACAAGAGACAACAGGTGTTACTGGTGTCTGTTATGG
L N L K Y A I S G K E R A R T V G G V S L L S T M T T R O Y
Replicase 1b

ATCAAAAACATCTTAAATCCATTGTTAATACACGCAATGCCACTGTTGTTATTGGTACTACCAAATTTTATGGTGGTTGGAATAATATGTTG 14168
TAGTTTTTGTAGAATTTAGGTAACAATTATGTGCGTTACGGTGACAACAATAACCATGATGGTTTAAATACCACCAACCTTATTATACAAC
H Q K H L K S I V N T R N A T V V I G T T K F Y G G W N N M L
Replicase 1b

CGTACTTTAATTGATGGTGTGAAACCCCTATGCTCATGGGTGGGATTATCCCAAATGTGATAGAGCTTTGCCTAACATGATACGTATGAT 14260
GCATGAAATTAACACCACAACCTTTGGGATACGAGTACCAACCCTAATAGGGTTTACACTATCTCGAAACGGATTGTACTATGCATACTA
R T L I D G V E N P M L M G W D Y P K C D R A L P N M I R M I
Replicase 1b

TTCAGCCATGGTGTGGGTTCTAAGCATGTTAATTGTTGACTGTAAACAGATAGGTTTTATAGGCTTGGTAACGAGTTGGCACAAGTTTTAA 14352
AAGTGGTACCACAACCAAGATTCTGACAATTAACAACATGACATTGTCTATCCAAATATCCGAACCATGCTCAACCGTGTTCAAAATT
S A M V L G S K H V N C C T V T D R F Y R L G N E L A O V L
Replicase 1b

CAGAAGTTGTTTATTCTAATGGTGGTTTTATTTTAAGCCAGGTGGTACGACTTCTGGTGACGCTAGTACAGCTTATGCTAATTCTATTTTT 14444
GTCTTCAACAAATAAGATTACCACCAAAAATAAAATTGCGTCCACCATGCTGAAGACCACTGCGATCATGTGCAATACGATTAAAGATAAAAA
T E V V Y S N G G F Y F K P G G T T S G D A S T A Y A N S I F
Replicase 1b

AACATTTTTCAAGCCGTGAGTTCTAACATTAACAGGTGCTTAGTGTCCCATCAGATTCATGTAATAATGTTAATGTTAGGGATCTACAACG 14536
TTGTAAAAAGTTCGGCACTCAAGATTGTAATTGTCCAACGAATCACAGGGTAGTCTAAGTACATTATTACAATTACAATCCCTAGATGTTGC
N I F O A V S S N I N R L L S V P S D S C N N V N V R D L O R
Replicase 1b

ACGTCTGTATGATAATTGCTATAGGTTAACTAGTGTGAAGAGTCATTCAATTGATGATTATTATGGTTATCTTAGGAAACATTTTTCAATGA 14628
TGCAGACATACTATTAACGATATCCAATTGATCACAACCTCTCAGTAAGTAACCTACTAATAATACCAATAGAATCCTTTGTAAAAAGTTACT
R L Y D N C Y R L T S V E E S F I D D Y Y G Y L R K H F S M
Replicase 1b

TGATTCTCTCTGATGACGGTGTGCTGTTATAACAAGGATTATGCTGAGTTAGGTTATATAGCAGACATTAGTGCTTTTAAAGCCACTTTG 14720
ACTAAGAGAGACTACTGCCACAACAGACAATATTGTTCTAATACGACTCAATCCAATATATCGTCTGTAATCACGAAAATTCGGTGAAAC
M I L S D D G V V C Y N K D Y A E L G Y I A D I S A F K A T L
Replicase 1b

TATTACCAGAATAATGTCTTTATGAGTACTTCTAAATGTTGGGTTGAAGAAGATTTAACTAAGGGACCACATGAGTTTTGTTCCAGCATAC 14812
ATAATGGTCTTATTACAGAAATACTCATGAAGATTACAACCCAATTCTTCTAAATTGATTCCTGGTGTACTCAAAACAAGGGTCGTATG
Y Y Q N N V F M S T S K C W V E E D L T K G P H E F C S Q H T
Replicase 1b

TATGCAATAGTTGATAAAGATGGTACCTATTATTTGCCTTACCAGATCCTAGTAGGATCTTGTGAGCTGGTGTGTTTTGTTGATGATGTTG 14904
ATACGTTTATCAACTATTTCTACCATGGATAATAAACGGAATGGGTCTAGGATCATCTAGAACAGTCGACCACAAAACAACACTACTACAAC
M O I V D K D G T Y Y L P Y P D P S R I L S A G V F V D D V
Replicase 1b

TTAAGACAGATGCTGTTGTTTTGTTAKAACGTTATGTGCTTTAGCTATTGATGCATACCCTCTTTCAAAACACCCTAATTCTGAATATCGT 14996
AATTCTGTCTACGACAACAAAACAATNTTGAATACACAGAAATCGATAACTACGTATGGGAGAAAGTTTTGTGGGATTAAGACTTATAGCA
V K T D A V V L L ? R Y V S L A I D A Y P L S K H P N S E Y R
Replicase 1b

AAGGTTTTTACGTATTACTTGATTGGGTAAAGCATCTTAACAAAAATTTGAATGAGGGTGTCTTGAATCTTTTTCTGTTACACTTCTTGA 15088
TTCCAAAAATGCATAATGAACCTAACCCAATTGCTAGAAATGTTTTTAACTTACTCCCACAAGAACTTAGAAAAAGACAATGTGAAGAACT
K V F Y V L L D W V K H L N K N L N E G V L E S F S V T L L D
Replicase 1b

TAATCAAGAAGATAAGTTTTGGTGTGAAGATTTTTATGCTAGTATGTATGAAAATTCTACAATATTGCAAGCTGCTGGCTTATGTGTTGTTT 15180
ATTAGTTCTTCTATTCAAAACCACACTTCTAAAAATACGATCATACTTTTAAGATGTTATAACGTTGACGACCGAATACACAACAA
N O E D K F W C E D F Y A S M Y E N S T I L O A A G L C V V
Replicase 1b

GTGGTTCACAACTGTTCTTCGTTGTGGTGATTGTCTGCGTAAGCCTATGTTGTGCACTAAATGTGCATATGATCATGTATTTGGTACCGAC 15272
CACCAAGTGTTTGACAAGAAGCAACACCACTAACAGACGATTGCGATACAACACGTGATTTACACGTATACTAGTACATAAACCATGGCTG
C G S O T V L R C G D C L R K P M L C T K C A Y D H V F G T D
Replicase 1b

CACAAGTTTATTTGGCTATAACACCGTATGTATGTAATGCATCAGTTGTGGTGTAGTGATGTTAAAAAATTGTATCTTGGTGGTTTGAA 15364
GTGTTCAAATAAAACCGATATTGTGGCATAACATACATTACGTAGTCCAACACCACAATCACTACAATTTTTTAACATAGAACCACCAAACCT
H K F I L A I T P Y V C N A S G C G V S D V K K L Y L G G L N
Replicase 1b

TTACTATTGTACAAATCATAAACCACAGTTGTCTTTCCATTATGTTCTGCTGGAATATATTTGGTTTATATAAAAAATTCAGCAACTGGTT 15456
AATGATAACATGTTTAGTATTTGGTGTCAACAGAAAAGGTAATACAAGACGACCATTATATAAACCAATATATTTTAAAGTCGTTGACCAA
Y Y C T N H K P Q L S F P L C S A G N I F G L Y K N S A T G
Replicase 1b

CCTTAGATGTTGAAGTTTTTAATAGGCTTGCAACGTCTGATTGGACTGATGTTAGGGACTATAAACTTGCTAATGATGTTAAAGATACACTT 15548
GGAATCTACAACCTCAAAAATTATCCGAACGTTGCAGACTAACCTGACTACAATCCCTGATATTTGAACGATTACTACAATTTCTATGTGAA
S L D V E V F N R L A T S D W T D V R D Y K L A N D V K D T L
Replicase 1b

AGACTCTTTGCGGCTGAACTATTAAGCTAAAGAAGAGAGTGTAAAGTCTTCTTATGCTTTTGCAACTCTTAAAGAGGTTGTTGGACCTAA 15640
TCTGAGAAACGCCGACTTTGATAATTTGATTCTTCTCTCACAATTCAGAAGAATACGAAAACGTTGAGAATTTCTCCAACAACCTGGATT
R L F A A E T I K A K E E S V K S S Y A F A T L K E V V G P K
Replicase 1b

AGAATTGCTTCTTAGTTGGGAAAGTGGTAAAGTTAAACCACCTTTGAATCGTAATTCGTTTTACCTGTTTTCAATAAGTAAGGACTCAA 15732
TCTTAACGAAGAATCAACCCTTTCACCATTCAATTTGGTGGAACTTAGCATTAAAGACAAAAGTGGACAAAAGTTATTCAATTCCTGAGTT
E L L L S W E S G K V K P P L N R N S V F T C F Q I S K D S
Replicase 1b

AATCCAAATAGGTGAGTTCATCTTTGAAAAGGTTGAATATGGTTCTGATACTGTTACGTATAAGTCTACTGTAACCACTAAGTTAGTTCTT 15824
TTAAGGTTTATCCACTCAAGTAGAACTTTTCCAACCTATACCAAGACTATGACAATGCATATTCAGATGACATTGGTGATTCAATCAAGGA
K F Q I G E F I F E K V E Y G S D T V T Y K S T V T T K L V P
Replicase 1b

GGTATGATTTTTGTCTTAACATCTCACAATGTTCAACCTTTACGTGCACCAACTATTGCAAACCAAGAGAAGTATTCTAGCATTATATAAAT 15916
CCATACTAAAAACAGAATTGTAGAGTGTACAAGTTGGAATGCACGTGGTTGATAACGTTTGGTTCTCTTCATAAGATCGTAAATATTTAA
G M I F V L T S H N V Q P L R A P T I A N Q E K Y S S I Y K L
Replicase 1b

GCACCCTGCTTTTATGTGAGTGATGCATATGCTAATTTGGTTCCATATTACCAACTTATTGGTAAACAAAAGATAACTACAATACAGGGTC 16008
CGTGGGACGAAAATTACAGTCACTACGTATACGATTAACCAAGGTATAATGGTTGAATAACCATTTGTTTTCTATTGATGTTATGTCCTCAG
H P A F N V S D A Y A N L V P Y Y Q L I G K Q K I T T I Q G
Replicase 1b

CTCCTGGTAGTGGAAGTCACATTGTTCCATTGGACTTGGATTGTACTATCCAGGTGCGCGTATTGTTTTGTTGCTTGTGCCCATGCTGCT 16100
GAGGACCATCACCATTCAAGTGAACAAGGTAACCTGAACCTAACATGATAGGTCCACGCGCATAACAAAAACAACGAACACGGGTACGACGA
P P G S G K S H C S I G L G L Y Y P G A R I V F V A C A H A A
Replicase 1b

GTTGATTCCTTATGTGAAAAGCTATGACTGTTTATAGCATTGATAAGTGTACTAGGATTATACCTGCAAGAGCTCGGGTTGAGTGTTATAG 16192
CAACTAAGGAATACACGTTTTGATACTGACAAATATCGTAACTATTCATGATCCTAATATGGACGTTCTCGAGCCCAACTCACAATATC
V D S L C A K A M T V Y S I D K C T R I I P A R A R V E C Y S
Replicase 1b

TGGCTTTAAACCAATAAAGTGTGACAAATACATATTTAGCACTGTTAACGCATTACCTGAGTGTAATGCTGATATTGTTGTTGTAGATG 16284
ACCGAAATTTGGTTTATTGTGATCAGTGTTATGTATAAATCGTGACAATTCGTAATGGACTCACATTACGACTATAACAACAACATCTAC
G F K P N N T S A Q Y I F S T V N A L P E C N A D I V V V D
Replicase 1b

AAGTTTCAATGTGTACAAATTATGACCTTTCTGTTATTAATCAGCGTTTATCATATAACATATTGTTTATGTTGGTGATCCACAACAACCTT 16376
TTCAAAGTTACACATGTTTAATACTGGAAAGACAATAATTAGTCGCAATAGTATATTTGTATAACAAATACAACCACTAGGTGTTGTTGAA
E V S M C T N Y D L S V I N D R L S Y K H I V Y V G D P Q Q L
Replicase 1b

CCTGCACCTAGAGTAATGATTACTAAAGGTGTTATGGAGCCTGTTGATTATAACGTTGTTACTCAACGTATGTTGCTATAGGCCCTGATGT
GGACGTGGATCTCATTACTAATGATTTCCACAATACCTCGGACAATAATATTGCAACAATGAGTTGCATACACGATATCCGGGACTACA 16468
P A P R V M I T K G V M E P V D Y N V V T Q R M C A I G P D V
Replicase 1b

TTTTCTTCATAAATGTTATAGATGTCCTGCTGAAATAGTTAATACAGTTTCTGAACTTGTTTATGAGAACAAGTTTGCCCTGTTAAACCTG
AAAAGAAGTATTTACAATATCTACAGGACGACTTTATCAATTATGTCAAAGACTTGAACAAATACTCTTGTTCAAACAGGGACAATTTGGAC 16560
F L H K C Y R C P A E I V N T V S E L V Y E N K F V P V K P
Replicase 1b

CTAGTAACAGTGTTTTAAATCTTTTTAAGGGTAATGTACAGGTTGACAATGGCTCTAGTATTAACAGAAAGCAGCTTGAAATAGTTAAG
GATCATTGTGCACAAAATTTAGAAAAAATCCCATACATGTCCAAGTGTACCGAGATCATAATTGTCTTTCGTCGAACCTTATCAATTC 16652
A S K Q C F K I F F K G N V O V D N G S S I N R K Q L E I V K
Replicase 1b

CTGTTTTTAGTTAAAAATCCAAGTTGGAGTAAGGCTGTGTTTATTCTCCTTATAATAGTCAGAATTATGTTGCTAGTAGATTTTTAGGACT
GACAAAATCAATTTTTAGGTTCAACCTCATTCCGACACAAATAAGAGGAATATTATCAGTCTTAATACAACGATCATCTAAAAATCCTGA 16744
L F L V K N P S W S K A V F I S P Y N S Q N Y V A S R F L G L
Replicase 1b

TCAAATTCAACTGTTGATTCTTCTCAAGGTAGTGAGTATGATTATGTAATCTATGCACAACTTCTGACACTGCACATGCTTGCAATGTAA
AGTTTAAGTTTGACAACATAAGAAGAGTTCCATCACTCATACTAATACATTAGATACGTGTTTGAAGACTGTGACGTGTACGAACGTTACATT 16836
Q I Q T V D S S Q G S E Y D Y V I Y A Q T S D T A H A C N V
Replicase 1b

ACCGTTTTAATGTTGCTATAACACGTGCTAAGAAGGGTATATTTTGTGTAATGTGTGATAAACTTTGTTTGATTCACTTAAGTTTTTGGAG
TGGCAAAATTACAACGATATTGTGCACGATTCTCCCATATAAAACACATTACACACTATTTTGAACAACTAAGTGAATTCAAAAAATC 16928
N R F N V A I T R A K K G I F C V M C D K T L F D S L K F F E
Replicase 1b

ATTAACATGCAGATTTACACTCTAGCCAGGTTTGTGGCTTGTTTAAAAATTTGTACACGCACTCCTCTTAATTTACCACCAACTCATGCACA
TAATTTGTACGTCTAAATGTGAGATCGGTCCAAACACCGAACAATTTTAAACATGTGCGTGAGGAGAATTAATGGTGGTTGAGTACGTGT 17020
I K H A D L H S S Q V C G L F K N C T R T P L N L P P T H A H
Replicase 1b

CACTTCTTGCTGTTGTCAGATCAGTTTAAGACTACAGGTGATTAGCTGTTCAAATAGGTTCAAATAATGTTTGTACTTATGAAACATGTTA
GTGAAAGAACAGCAACAGTCTAGTCAAATCTGATGTCCAATAATCGACAAGTTTATCCAAGTTTATTACAAACATGAATACTTGTACAAT 17112
T F L S L S D Q F K T T G D L A V Q I G S N N V C T Y E H V
Replicase 1b

TATCATTATGGGTTTTAGGTTTGATATTAGTATTCCTGGTAGTCATAGTTTGTGTTTGTACACGTGACTTTGCTATTGTAATGTGCGTGGT
ATAGTAAATACCCAAAATCCAACTATAATCATAAGGACCATCAGTATCAAACAAAACATGTGCACTGAAACGATAAGCATTACACGCACCA 17204
I S F M G F R F D I S I P G S H S L F C T R D F A I R N V R G
Replicase 1b

TGGTTGGGTATGGATGTTGAAAGTGCTCATGTTTGTGGCGATAACATAGGTACTAATGTTCTTTACAGGTTGGTTTTTCAAATGGTGTTAA 17296
ACCAACCCATACCTACAACCTTTCACGAGTACAACACCGCTATTGTATCCATGATTACAAGGAAATGTCCAACCAAAAAGTTTACCACAATT
W L G M D V E S A H V C G D N I G T N V P L Q V G F S N G V N
Replicase 1b

TTTTGTTGTGCAAACTGAAGGTTGTGTGTCTACCAATTTTGGTGATGTTATTAAACCTGTTTGTGCAAAATCTCCACCAGGTGAACAATTTA 17388
AAAACAACACGTTTGACTTCCAACACACAGATGGTTAAAACCACTACAATAATTGGACAAACACGTTTTAGAGGTGGTCCACTTGTTAAT
F V V Q T E G C V S T N F G D V I K P V C A K S P P G E Q F
Replicase 1b

GACACCTGTTCTTTTTTACGTAAAGGACAACCTTGGTTAATTGTTTCGTAGACGCATTGTGCAATGATATCTGATTATTTGTCCAATTTG 17480
CTGTGGAACAAGGAAAAATGCATTTCTGTTGGAACCAATTAACAAGCATCTGCGTAACACGTTTACTATAGACTAATAACAGGTTAAAC
R H L V P F L R K G Q P W L I V R R R I V Q M I S D Y L S N L
Replicase 1b

TCTGACATTCTTGCTTTGTTTTGTGGGCGAGGTAGTTTGAATTAACATAATCGGTTACTTTGTAAAAATAGGGCCAATTAATATTGTTA 17572
AGACTGTAAGAACAGAAACAAACACCGTCCATCAAACCTTAATTGATGTTACGCAATGAAACATTTTTATCCGGTTAATTATAACAAT
S D I L V F V L W A G S L E L T T M R Y F V K I G P I K Y C Y
Replicase 1b

TTGTGGTAATCTGCCACTTGTATAATTCAGTTAGTAATGAATATTGTTGTTTTAAACATGCATTGGGTTGTGATTATGTTTACAATCCGT 17664
AACACCATTAAAGACGGTGAACAATATTAAGTCAATCATTACTTATAACAACAAAATTTGTACGTAACCCAACACTAATACAATGTTAGGCA
C G N S A T C Y N S V S N E Y C C F K H A L G C D Y V Y N P
Replicase 1b

ATGCTTTTGATATACAACAGTGGGTTATGTTGGTTCCTTGAGCCAGAACCACCACACGTTCTGTAACATTCATAGAAACGAGCATGATGCT 17756
TACGAAACTATATGTTGTCAACCAATACAACCAAGGAACCGGTCCTGGTGGTGTGCAAGACATTGTAAGTATCTTTGCTCGTACTACGA
Y A F D I Q Q W G Y V G S L S Q N H H T F C N I H R N E H D A
Replicase 1b

TCTGGTGATGCTGTTATGACACGTTGTTTGGCAGTACATGATTGTTTTGTCAAAATGTTGATTGGACTGTAACGTACCCCTTTATTGCAAA 17848
AGACCACTACGACAATACTGTGCAACAAACCGTCATGTACTAACAAAACAGTTTTTACAATAACCTGACATTGCATGGGGAAATAACGTTT
S G D A V M T R C L A V H D C F V K N V D W T V T Y P F I A N
Replicase 1b

TGAGAAATTTATCAATGGCTGTGGGCGTAATGTCCAGGGACATGTTGTTTCGCGCAGCCTTGAAATTGTATAAACCTAGTGTTATTCATGATA 17940
ACTCTTTAAATAGTTACCGACACCGCATTACAGTCCCTGTACAACAAGCGCGTCGGAACCTTTAACATATTTGGATCACAATAAGTACTAT
E K F I N G C G R N V Q G H V V R A A L K L Y K P S V I H D
Replicase 1b

TTGGTAATCCTAAAGGTGTACGTTGTGCTGTTACTGATGCCAAATGGTACTGTTATGACAAGCAACCTGTTAATAGTAATGTCAAGTTGTTG 18032
AACCATTAGGATTTCCACATGCAACACGACAATGACTACGGTTTACCATGACAATACTGTTTCGTTGGACAATTATCATTACAGTTCAACAAC
I G N P K G V R C A V T D A K W Y C Y D K O P V N S N V K L L
Replicase 1b

GATTATGATTATGCAACCCATGGTCAACTTGATGGTCTTTGTTTATTCTGGAATTGTAATGTTGATATGTATCCAGAATTTTCAATTGTGTG
CTAATACTAATACGTTGGGTACCAGTTGAACCTACCAGAAACAAATAAGACCTTAACATTACAACCTATACATAGGTCTTAAAGTTAACACAC 18124
D Y D Y A T H G O L D G L C L F W N C N V D M Y P E F S I V C
Replicase 1b

TCGCTTTGACACACGTACTCGTTCTGTTTTAATTTAGAAGGTGTTAATGGTGGTCTCTTTATGTTAACAACATGCGTTTCATACACCAG
AGCGAAACTGTGTGCATGAGCAAGACAAAATTAATCTTCCACAATTACCACCAAGAGAAATACAATTGTTGTACGCAAAGTATGTGGTC 18216
R F D T R T R S V F N L E G V N G G S L Y V N K H A F H T P
Replicase 1b

CATATGATAACGTGCTTTTGTTAAATTAACCTATGCCCTTTTTTACTTTGATGACAGTGATTGTGATGTTGTGCAAGAACAAGTTAAT
GTATACTATTTGCACGAAAACAATTTAATTTGGATACGGGAAAAAATGAACTACTGTCTACTAACACTACAACACGTTCTTGTTCATTA 18308
A Y D K R A F V K L K P M P F F Y F D D S D C D V V Q E Q V N
Replicase 1b

TATGTACCCCTTCGCGCTAGTAGTTGTGTACCCGTTGTAATATAGGTGGTGTCTGTTTGTTCAAAACATGCAAATTTGTATCAAAAATATGT
ATACATGGGAAGCGCGATCATCAACACAATGGGCAACATTATATCCACCACGACAACAAGTTTGTACGTTTAAACATAGTTTATATACA 18400
Y V P L R A S S C V T R C N I G G A V C S K H A N L Y O K Y V
Replicase 1b

TGAGGCATATAATACATTTACACAGGCTGGTTTTAACATTTGGGTACCACATAGTTTTGATGTTTATAATTTGTGGCAAATTTTATTGAAA
ACTCCGTATATTATGTAATGTGTCCGACCAAAATGTAAACCATGGTGTATCAAACTACAAATATTAAACACCGTTTAAAAATACTTT 18492
E A Y N T F T O A G F N I W V P H S F D V Y N L W O I F I E
Replicase 1b

CTAATTTACAAAGTCTTGAAAATATAGCATTTAATGTTGTAAAAAAGGGTGTCTTACTGGTGTGATGGTGAGTTACCTGTTGCAGTTGTT
GATTAATGTTTCAGAACTTTTATATCGTAAATTACAACATTTTTTCCACAAAATGACCACAACCTACCCTCAATGGACAACGTCAACAA 18584
T N L Q S L E N I A F N V V K K G C F T G V D G E L P V A V V
Replicase 1b

AACGACAAAGTTTTTGTTCGCTATGGCGATGTTGACAACCTGGTTTTTACAAATAAAACAACATTGCCTACTAATGTTGCTTTTGAATTGTT
TTGCTGTTTCAAAAACAAGCGATACCGCTACAACCTGTTGAACCAAAAATGTTTATTTGTTGTAACGGATGATTACAACGAAAACCTTAACAA 18676
N D K V F V R Y G D V D N L V F T N K T T L P T N V A F E L F
Replicase 1b

TGCAAAACGAAAAATGGGTTTAAACACCACCATTTGCTATTCTCAAAAATCTTGGTGTGTTGCTACATATAAATTTGTTTTATGGGATTATG
ACGTTTGTCTTTTACCCAAATTTGTTGGTGAACAGATAAGAGTTTTAGAACCAACAACGATGTATATTAAACAAAATACCCTAATAC 18768
A K R K M G L T P P L S I L K N L G V V A T Y K F V L W D Y
Replicase 1b

AAGCTGAAAGACCTTTTACCTCATATACTAAGAGTGATGTAAATACACTGATTTTAAATGAGGATGTTTGTGTTTGTGTTTACAAATAGTATT
TTGCACTTTCTGAAAATGGAGTATATGATTCTCACATACATTTATGTGACTAAAATTACTCTACAAACACAAACAAAACCTGTTATCATAA 18860
E A E R P F T S Y T K S V C K Y T D F N E D V C V C F D N S I
Replicase 1b

CAGGGTTCGTATGAGCGTTTTACGCTTACTACGAACGCTGTTTTATTTTCTACTGTTGTCATTAAAAATTTAACACCTATAAAGTTGAATTT
GTCCAAGCATACTCGCAAAATGCGAATGATGCTTGCACAAAATAAAAGATGACAACAGTAATTTTTAAATTGTGGATATTTCAACTTAA
18952
O G S Y E R F T L T T N A V L F S T V V I K N L T P I K L N F
Replicase 1b

TGGTATGTTGAATGGTATGCCAGTTTCTTCTATTAAGAGTGATAAAGGTGTTGAAAAATTAGTTAATTGGTACACATATGTTGTAATAATG
ACCATACAACCTACCATACGGTCAAAGAAGATAATTCTCACTATTTCCACAACCTTTTAATCAATTAACCATGTGTATACAAGCATTTTAC
19044
G M L N G M P V S S I K S D K G V E K L V N W Y T Y V R K N
Replicase 1b

GTCAATTTCAAGATCATTATGATGGTTTTTACACTCAAGGTAGGAATTTATCAGACTTTACACCAAGAAGTGATATGGAGTATGATTTTCTT
CAGTTAAAGTTCTAGTAATACTACCAAAAATGTGAGTTCCATCCTTAAATAGTCTGAAATGTGGTTCTTCACTATACCTCATACTAAAAGAA
19136
G Q F Q D H Y D G F Y T O G R N L S D F T P R S D M E Y D F L
Replicase 1b

AACATGGATATGGGTGTTTTTATTAATAAATATGGTCTTGAGGATTTTAAATTTGAACATGTTGTATATGGTGATGTTTCAAAAACCTACATT
TTGTACCTATACCCACAAAATAATTATTTATACCAGAAGTCTTAAATTAACCTTGTAACATATACCACTACAAAGTTTTGTATGTA
19228
N M D M G V F I N K Y G L E D F N F E H V V Y G D V S K T T L
Replicase 1b

AGGAGGTCTTCATTTGTTGATATCACAGTTTAGGCTTAGTAAATGGGTGTTTGAAGCTGATGATTTTGTCTGCTTCTGACACAACCTT
TCCTCCAGAAGTAAACAACATATAGTGTCAAATCCGAATCATTTACCCACAAAACCTTCGACTACTAAACAGTGACGAAGACTGTGTTGAA
19320
G G L H L L I S O F R L S K M G V L K A D D F V T A S D T T
Replicase 1b

TGAGGTGCTGACTGTTACTTATCTTAATGAACCTAGTTCAAAAGTTGTTGTACTTATATGGATTTGTTGTTGGACGACTTTGTTACTATA
ACTCCACGACATGACAATGAATAGAATTACTTGAATCAAGTTTCAACAAACATGAATATACCTAAACAACAACCTGCTGAAACAATGATAT
19412
L R C C T V T Y L N E L S S K V V C T Y M D L L L D D F V T I
Replicase 1b

CTAAAGAGTTTAGATCTTGGTGTAATATCTAAAGTTCATGAAGTTATTATAGATAATAAACCTTATAGGTGGATGTTGTTGGTGTAAGATAA
GATTTCTCAAATCTAGAACCACATTATAGATTTCAAGTACTTCAATAATATCTATTATTTGGAATATCCACCTACAACACCACATTTCTATT
19504
L K S L D L G V I S K V H E V I I D N K P Y R W M L W C K D N
Replicase 1b

CCACTTGTGCACTTTTTATCCACAGTTGCAGTCTGCTGAATGGAAGTGTTGTTATGCTATGCCACAAATTTATAAGCTTCAACGTATGTGTT
GGTGAACAGCTGAAAAATAGGTGTCAACGTCAGACGACTTACCTTCACACCAATACGATACGGTGTTTAAATATTGGAAGTTGCATACACAA
19596
H L S T F Y P O L O S A E W K C G Y A M P O I Y K L Q R M C
Replicase 1b

TGGAACCTTGTAATTTATATAATTATGGTGCTGGTATTAAGTTGCCTAGTGGTATAATGTTAAATGTTGTTAAATACACTCAGCTTTGTCAA
ACCTTGGAACATTAAATATATTAATACCAGACCATTAATCAACGGATCACCATATTACAATTACAACAATTTATGTGAGTCGAAACAGTT
19688
L E P C N L Y N Y G A G I K L P S G I M L N V V K Y T O L C O
Replicase 1b

TACCTAAATAGCACTACAATGTGCGTACCTCATAATATGCGTGTTTTGCACTATGGTGCTGGTTCTGACAAAGGTGTGGCACCTGGTACAAC
ATGGATTATCGTGATGTTACACGCATGGAGTATTATACGCACAAAACGTGATACCACGACCAAGACTGTTTCCACACCGTGGACCATGTTG 19780
Y L N S T T M C V P H N M R V L H Y G A G S D K G V A P G T T
Replicase 1b

TGTTTTAAACGTTGGCTACCACTGATGCAATAATCATTGATAATGATATCAATGATTATGTTAGTGATGCAGATTTTAGCATTACAGGTG
ACAAAATTTTGAACCGATGGTGGACTACGTTATTAGTAACTATTACTATAGTTACTAATAACAATCACTACGTCTAAAATCGTAATGTCCAC 19872
V L K R W L P P D A I I I D N D I N D Y V S D A D F S I T G
Replicase 1b

ATTGTGCTACTGTTTACCTTGAAGATAAGTTTGACTTACTTATTTCTGATATGTATGATGGTAGAATTAAATTTTGTGATGGTGAAAACGTC
TAACACGATGACAAATGGAACCTTCTATTCAAAGTGAATAAAGACTATACATACTACCCTTAATTTAAACACTACCACTTTTGCAG 19964
D C A T V Y L E D K F D L L I S D M Y D G R I K F C D G E N V
Replicase 1b

TCTAAAGATGGTTTTTTTACTTATCTTAATGGTGTTATTAGAGAAAATTAGCTATTGGTGGTAGTGTGCCATTAAGATTACAGAATATAG
AGATTTCTACCAAAAAAATGAATAGAATTACCACAATAATCTCTTTTAAATCGATAACCACCATCACAAACGGTAATTCTAATGTCTTATATC 20056
S K D G F F T Y L N G V I R E K L A I G G S V A I K I T E Y S
Replicase 1b

TTGGAATAAGTATCTTTATGAATTAATACAAAGATTGCTTTTTGGACTTTGTTCTGCACGTCTGTTAATACATCTCTTCAGAAGCTTTTC
AACCTTATTCATAGAAATACTTAATTATGTTTCTAAACGAAAAACCTGAAACAAGACGTGCAGACAATTATGTAGGAGAAGTCTTCGAAAAAG 20148
W N K Y L Y E L I O R F A F W T L F C T S V N T S S S E A F
Replicase 1b

TTATTGGTATTAATTATTTAGGTGACTTTATTCAAGGTCCTTTTATAGCTGGTAACACTGTTTCATGCTAATTATATATTTTGGCGTAATTCT
AATAACCATAATTAATAATCCACTGAAATAAGTTCAGGAAAATATCGACCATTGTGACAAGTACGATTAATATATAAAACCGCATTAAGA 20240
L I G I N Y L G D F I O G P F I A G N T V H A N Y I F W R N S
Replicase 1b

ACTATTATGTCTTTGTCATACAATTCAGTTTTAGATTTAAGTAAGTTTGAATGTAAACATAAGGCCACTGTTGTTGTTACACTTAAAGATAG
TGATAATACAGAAACAGTATGTTAAGTCAAATCTAAATTCATTCAAACCTTACATTTGTATTCCGGTGACAACAACATGTGAATTTCTATC 20332
T I M S L S Y N S V L D L S K F E C K H K A T V V V T L K D S
Replicase 1b

TGATGTAATGATATGGTTTTGAGTTTGATTAAGAGTGGTAGGTTGTTGTTACGTAATAGTGGCCGTTTTGGTGGTTTTAGTAATCATTTAG
ACTACATTTACTATACCAAACTCAAATAATTCTCACCATCCAACAACATGCATTATCACCGGCAAAACCAACCAAAATCATTAGTAAATC 20424
D V N D M V L S L I K S G R L L L R N S G R F G G F S N H L
Replicase 1b

TCTCAACTAAATGAACTTTTCTTGATTTTGCTTATTTGCCCTGGTTTCTTGCTTTTCTACATGTAACAGTAATGCTAGTATTTCTATGT
AGAGTTGATTTACTTTGAAAAGAACTAAAACGAATAAAACGGGGACCAAGAAGATGTACATTGTCATTACGATCATAAGATACA 20516

M K L F L I L L I L P L V S C F S T C N S N A S I S M
Spike

V S T K
—Replicase 1b—

TACAATTAGGTGTTCTCGATAACTCTTCAACTATTGTCACAGGTTTGTGCGCAGTCCATTGGATTGTGCTAATCAGAGTACATCTAGTTAC
ATGTTAATCCACAAGGACTATTGAGAAGTTGATAACAGTGTCCAAACAACGGTCAGGTAACCTAAACAGGATTAGTCTCATGTAGATCAATG 20608

L O L G V P D N S S T I V T G L L P V H W I C A N Q S T S S Y
Spike

CCAGCCAACGGCTTTTCTATATTGATGTTGGTAAACACCGTAGTGCCTTTGCACTCCATAGTGGTTATTATGATGCTAACCAGTATTATAT
GGTCGGTTGCCGAAAAAGATATAACTACAACCATTTGTGGCATCACGGAACGTGAGGTATCACCAATAATACTACGATTGGTCATAATATA 20700

P A N G F F Y I D V G K H R S A F A L H S G Y Y D A N Q Y Y I
Spike

TTATCTCACTAATAAAATACATTTAAATGCTCCTGTCACTCTGAAGATTGTAAAGTTTGGAAACACTTCTTTGATTTTTTAAGTAATGTTT
AATAGAGTGATTATTTTATGTAAATTTACGAGGACAGTGAGACTTCTAAACATTCAAACCTTTGTGAAGAAAACATAAAATTCATTACAAA 20792

Y L T N K I H L N A P V T L K I C K F G N T S F D F L S N V
Spike

CTACTTCTCATGATTGTATAGTTAATTTGTCATTACAGAACAGTTAGGTGTGCCTTTGGGCATAACTATATCGGGTGAAACTGTACGTTTG
GATGAAGAGTACTAACATATCAATTAACAGTAAGTGCTTGTCAATCCACACGGAACCCGTATTGATATAGCCCACTTTGACATGCAAAAC 20884

S T S H D C I V N L S F T E O L G V P L G I T I S G E T V R L
Spike

CATTATATAATGCAACTCGTACTTTTTATGTGCCGGCGCTTATAAACTTACTAAACTTAGTGTTAAATGTTACTTTAGTGAATCCTGTGT
GTAAATATATTACGTTGAGCATGAAAAATACACGGCCGGCGAATTTGAATGATTGGAATCACAAATTTACAATGAAATCACTTAGGACACA 20976

H L Y N A T R T F Y V P A A Y K L T K L S V K C Y F S E S C V
Spike

TTTTAGTGTGTCAATGCCACCATTACTGTTAATGTCACCACTTAATGGCCGTATAGTTAACTACACTGTTTGTGATGATTGTAATGGTT
AAAATCACAAACAGTTACGGTGGTAATGACAATTACAGTGGTGTGAATTACCGGCATATCAATTGATGTGACAAACACTACTAACATTACCAA 21088

F S V V N A T I T V N V T T L N G R I V N Y T V C D D C N G
Spike

ATACTGATAACATATTTTCTGTTCAACAGGATGGCCGCATTCTAATGGTTTCCCTTTTAATAATTGGTTTTTGTAACTAATGGTTCCACA
TATGACTATTGTATAAAAGACAAGTTGTCTACCGGCGTAAGGATTACCAAAGGAAAATTATTAACCAAAAACAATTGATTACCAAGGTGT 21160

Y T D N I F S V Q O D G R I P N G F P F N N W F L L T N G S T
Spike

TTAGTGGACGGGGTCTCTAGACTTTATCAACCACTCCGTTTAACTTGTTTATGGCCTGTACCTGGTCTTAAATCTTCAACTGGTTTTGTTA
AATCACCTGCCCCAGAGATCTGAAATAGTTGGTGAGGCAAATTGAACAAATACCGGACATGGACCAGAATTTAGAAGTTGACCAAAACAAAT 21252
L V D G V S R L Y O P L R L T C L W P V P G L K S S T G F V Y
Spike

TTTTAATGCCACTGGTCTGATGTTAATTGTAACGGCTATCAACATAATTCTGTTGCTGATGTTATGCGTTACAATCTTAACCTCAGTGCTA
AAAATTACGGTGACCAAGACTACAATTAACATTGCCGATAGTTGTATTAAGACAACGACTACAATACGCAATGTTAGAATTGGAGTCACGAT 21344
F N A T G S D V N C N G Y O H N S V A D V M R Y N L N L S A
Spike

ATTCTGTGGACAATCTTAAGAGTGGTGTATAGTTTTTAAACCTTACAGTACGATGTTTTGTTTTATTGTAGTAATCTTCTTCAGGTGTT
TAAGACACCTGTTAGAATCTCACCACAATATCAAAAATTTGAAATGTCATGCTACAAAACAAAATAACATCATTAGAAGAAGTCCACAA 21436
N S V D N L K S G V I V F K T L O Y D V L F Y C S N S S S G V
Spike

CTTGACACCACAATACCTTTTGGCCCTTCTCTCAACCTTATTACTGTTTTATAAACAGTACTATCAACACTACTCATGTTAGCACTTTTGT
GAACTGTGGTGTATGAAAAACCGGGAAGGAGAGTTGGAATAATGACAAAATATTGTGATGATAGTTGTGATGAGTACAATCGTGAAAAACA 21528
L D T T I P F G P S S O P Y Y C F I N S T I N T T H V S T F V
Spike

GGGTATTTTACCACCACTGTGCGTGAAATTGTTGTTGCTAGAACTGGTCAGTTTTATATTAATGGTTTTAAGTATTTGATTGGGTTTCA
CCATAAAATGGTGGGTGACACGCACTTTAACAACAACGATCTTGACCAGTCAAAATATAATTACCAAAATTCATAAAGCTAAACCCAAAGT 21620
G I L P P T V R E I V V A R T G O F Y I N G F K Y F D L G F
Spike

TAGAAGCTGTCAATTTTAATGTCACGACTGCTAGTGCCACAGATTTTTGGACGGTTGCATTTGCTACTTTTGTGATGTTTTGGTTAATGTT
ATCTTCGACAGTTAAAATTACAGTGCTGACGATCAGGTTGCTAAAAACCTGCCAACGTAAACGATGAAAACAACCTACAAAACCAATTACAA 21712
I E A V N F N V T T A S A T D F W T V A F A T F V D V L V N V
Spike

AGTGCAACTAACATTCAAACTTACTTTATTGCGATTCTCCATTTGAAAAGTTGCAGTGTGAGCACTTGCAGTTTGGATTGCAAGATGGTTT
TCACGTTGATTGTAAGTTTGAATGAAATAACGCTAAGAGGTAAACTTTTCAACGTCACACTCGTGAACGTCAAACCTAACGTTCTACCAAA 21804
S A T N I O N L L Y C D S P F E K L O C E H L O F G L O D G F
Spike

TTATTCTGCAAATTTTCTTGATGATAATGTTTTGCCTGAGACTTATGTTGCACTCCCCATTTATTATCAACATACGGACATAAATTTTACTG
AATAAGACGTTTAAAGAACTACTATTACAAAACGGACTCTGAATACAACGTGAGGGGTAAATAATAGTTGTATGCTGTATTTAAATGAC 21896
Y S A N F L D D N V L P E T Y V A L P I Y Y O H T D I N F T
Spike

CAACTGCATCTTTTGGTGGTCTTGTATGTTTGTAAACCACGCCAGGTTAATATATCTCTTAATGGTAACACTTCAGTGTGTGTTAGAACA
GTTGACGTAGAAAACCAAGAACAATACAACATTTGGTGCGGTCCAATTATATAGAGAATTACCATTGTGAAGTCACACACAATCTTGT 21988
A T A S F G G S C Y V C K P R O V N I S L N G N T S V C V R T
Spike

TCTCATTTTCAATTAGGTATATTTATAACCGCGTTAAGAGTGGTTCACCAGGTGACTCTTCATGGCATATTTATTTAAAGAGTGGCACTTG
AGAGTAAAGGTTAATCCATATAAATATTGGCGCAATTCTCACCAAGTGGTCCACTGAGAAGTACCGTATAAATAAATTTCTCACCGTGAAC 22080
S H F S I R Y I Y N R V K S G S P G D S S W H I Y L K S G T C
Spike

TCCATTTTCTTTTCTAAGTTAAATAATTTTCAAAAGTTTAAAGACTATTTGTTTCTCAACCGTGAAGTGCCTGGTAGTTGTAATTTTCCAC
AGGTAAAGAAAAAGATTCAATTTATTAAGTTTCAAAATCTGATAAACAAGAGTTGGCAGCTTCACGGACCATCAACATTAAAGGTG 22172
P F S F S K L N N F Q K F K T I C F S T V E V P G S C N F P
Spike

TTGAAGCCACCTGGCATTACACTTCTTATACTATTGTTGGTGCTTTGTATGTTACTTGGTCTGAAGGTAATTCATTACTGGTGTACCTTAT
AACTTCGGTGGACCGTAATGTGAAGAATATGATAACAACCACGAAACATACAATGAACCAGACTTCATTAAGGTAATGACCACATGGAATA 22264
L E A T W H Y T S Y T I V G A L Y V T W S E G N S I T G V P Y
Spike

CCTGTCTCTGGTATTCGTGAGTTTAGTAATTTAGTTTAAATAATTGTACCAATATAATATTTATGATTATGTTGGTACTGGAATTATACG
GGACAGAGACCATAAGCACTCAAATCATTAAATCAAATTTATTAACATGGTTTATATTATAAATACTAATAACAACCATGACCTTAATATGC 22356
P V S G I R E F S N L V L N N C T K Y N I Y D Y V G T G I I R
Spike

TTCTTCAAACCAGTCACTTGCTGGTGGTATTACATATGTTTCTAACTCTGTAATTTACTTGGTTTAAAAATGTTTCCACTGGTAACATTT
AAGAAGTTTGGTCAGTGAACGACCACCATAATGTATACAAAGATTGAGACCATTAAATGAACCAAAATTTTACAAAGGTGACCATTGTAAA 22448
S S N Q S L A G G I T Y V S N S G N L L G F K N V S T G N I
Spike

TTATTGTGACACCATGTAACCAACCAGATCAAGTAGCTGTTTATCAACAAAGCATTATTGGTGCCATGACCGCTGTTAATGAGTCTAGATAT
AATAACACTGTGGTACATTGGTTGGTCTAGTTCATCGACAAATAGTTGTTTCGTAATAACCACGGTACTGGCGACAATTACTCAGATCTATA 22540
F I V T P C N Q P D Q V A V Y Q Q S I I G A M T A V N E S R Y
Spike

GGCTTGCAAACTTACTACAGTTACCTAACTTTTATTATGTTAGTAATGGTGGTAACAATTGCACTACGGCTGTTATGATTATTCTAATTT
CCGAACGTTTGAATGATGTCAATGGATTGAAAATAATAACAATCATTACCACCATTGTTAACGTGATGCCGACAATACTAAATAAGATTAAA 22632
G L O N L L Q L P N F Y Y V S N G G N N C T T A V M I Y S N F
Spike

TGGTATTTGTGCTGATGGTCTTTAATTCCTGTTTCGTCGCGTAATTTCTAGTGATAATGGTATTTTACGCCATAATCACTGCTAATTTATCCA
ACCATAAACAGACTACCAAGAAATTAAGGACAAGCAGGCGCATTAAAGTCACTATTACCATAAAGTCGGTATTAGTGACGATTAAATAGGT 22724
G I C A D G S L I P V R P R N S S D N G I S A I I T A N L S
Spike

TTCCCTCTAACTGGACTACTTCAGTTCAAGTTGAGTACCTCCAAATTACTAGTACTCCAATAGTTGTTGATTGTGCTACTTATGTGTGTAAT
AAGGGAGATTGACCTGATGAAGTCAAGTTCAACTCATGGAGGTTTAAATGATCATGAGGTTATCAACAATAACACGATGAATACACACATTA 22816
I P S N W T T S V Q V E Y L Q I T S T P I V V D C A T Y V C N
Spike

GGTAACCCTCGTTGTAAGAATCTACTTAAGCAGTATACTTCTGCTTGTAAACTATTGAAGATGCCTTACGACTTAGTGCTCATTGGAAAC
CCATTGGGAGCAACATTCTTAGATGAATTCGTCATATGAAGACGAACATTTTGATAACTTCTACGGAATGCTGAATCACGAGTAAACCTTTG 23908

G N P R C K N L L K O Y T S A C K T I E D A L R L S A H L E T
Spike

TAATGATGTTAGTAGTATGCTAACTTTTCGATAGCAATGCTTTTAGTTGGCTAATGTTACTAGTTTTGGAGATTATAACCTTTCTAGTGTTT
ATTACTACAATCATCATACGATTGAAAGCTATCGTTACGAAAATCAAACCGATTACAATGATCAAAACCTCTAATATTGGAAAGATCACAAA 23900

N D V S S M L T F D S N A F S L A N V T S F G D Y N L S S V
Spike

TACCTCAGAGAAACATTCATTCAAGCCGTATAGCAGGACGTAGTGCTTTGGAAGATTGTTGTTTAGCAAAGTTGTTACATCTGGTTTGGGT
ATGGAGTCTCTTTGTAAGTAAGTTCGGCATATCGTCTGCATCACGAAACCTTCTAAACAACAAATCGTTTCAACAATGTAGACCAAAACCA 23992

L P Q R N I H S S R I A G R S A L E D L L F S K V V T S G L G
Spike

ACTGTTGATGTTGACTATAAGTCTTGTAAGGCTTTTCTATTGCTGACCTTGCTTGCTCAGTACTACAATGGCATAATGGTTTTGCC
TGACAACTACAATGATATTCAGAACATGATTTCCAGAAAGATAACGACTGGAACGAACACGAGTCATGATGTTACCGTATTACCAAAACGG 23184

T V D V D Y K S C T K G L S I A D L A C A Q Y Y N G I M V L P
Spike

AGGTGTTGCTGATGCTGAACGTATGGCCATGTACAGGTTCTCTTATAGGTGGCATGGTGCTCGGAGGTCTTACATCAGCAGCCGCCATAC
TCCACAACGACTACGACTTGCATACCGGTACATGTGTCCAAGAGAATATCCACCGTACCACGAGCCTCCAGAATGTAGTCGTCGGCGGTATG 23276

G V A D A E R M A M Y T G S L I G G M V L G G L T S A A A I
Spike

CTTTTTCTTTGGCACTGCAAGCAGGACTTAACATGTTGCTTTACAACTGATGTGCTTCAAGAAAATCAGAAAATTTTGGCTGCATCATT
GAAAAAGAAACCGTGACGTTGCTGCTGAATTGATACAACGAAATGTTTGACTACCGAAGTCTTTTAGTCTTTTAAACCGACGTAGTAA 23368

P F S L A L O A R L N Y V A L O T D V L O E N O K I L A A S F
Spike

AATAAGGCTATTAATAATATTGTTGCTTCTTTTAGTAGCGTTAATGATGCTATTACACATACTGCAGAGGCTATACATACTGTTACTATTGC
TTATTCGATAATTATTATAACAACGAAGAAAATCATCGCAATTACTACGATAATGTGTATGACGTCTCCGATATGTATGACAATGATAACG 23460

N K A I N N I V A S F S S V N D A I T H T A E A I H T V T I A
Spike

ACTTAATAAGATTGAGTGTGTTAATCAACAGGGTAGTGCTCTTAACCATCTCACTTCACAATTGAGACATAATTTTCAGGCCATTTCTA
TGAATTATTCTAAGTCTTACAACAATTAGTTGTCCCATCACGAGAATTGGTAGAGTGAAGTGTTAACTCTGTATTAAAAGTCCGGTAAAGAT 23552

L N K I O D V V N O Q G S A L N H L T S Q L R H N F O A I S
Spike

ATTCAATTCATGCTATTTATGACCGGCTTGATTCAATTCAAGCCGATCAACAAGTTGACAGATTAATTACTGGACGGCTTGACGCTTTGAAT
TAAGTTAAGTACGATAAATACTGGCCGAACTAAGTTAAGTTGGCTAGTTGTTCAACTGTCTAATTAATGACCTGCCGAACGTCGAAACCTA 23644

N S I H A I Y D R L D S I O A D O O V O R L I T G R L A A L N
Spike

GCATTTGTTTCCCAAGTTTGAATAAATATACTGAAGTTCGTGGTTCGAGACGCTTAGCACAGCAGAAGATTAAATGAATGTGTCAAGTCACA 23736
CGTAAACAAAGGGTTCAAAACTTATTTATATGACTTCAAGCACCAAGGCTCGGAATCGTGTCTTCTAATTACTTACACAGTTCAGTGT
A F V S O V L N K Y T E V R G S R R L A O O K I N E C V K S O
Spike

ATCTAATAGATATGGTTTTTGTGGCAATGGCACTCACATCTTTCAATCGTCAACTCAGCTCCAGATGGTTTGCTTTTCTTCATACTGTTT 23828
TAGATTATCTATACCAAAACACCGTTACCGTGAGTGAGAAAAGTTAGCAGTTGAGTCGAGGTCTACCAACGAAAAAGAAGTATGACAAA
S N R Y G F C G N G T H I F S I V N S A P D G L L F L H T V
Spike

TGCTGCCAACTGATTACAAGAATGTAAAGGCGTGGTCTGGTATCTGTGTTGATGGCATTATGGCTATGTTCTGCGTCAACCTAACTTGGTT 23920
ACGACGGTTGACTAATGTTCTTACATTTCCGCACCAGACCATAGACACAACCTACCGTAAATACCGATACAAGACGCAGTTGGATTGAACCAA
L L P T D Y K N V K A W S G I C V D G I Y G Y V L R O P N L V
Spike

CTTTATTCTGATAATGGTGTCTTTTCGTGTAACCTCCAGGGTCATGTTTCAACCTCGTTTACCTGTTTTGTCTGATTTTGTGCAAATATATAA 24012
GAAATAAGACTATTACCACAGAAAGCACATTGAAGGTCCAGTACAAGTTGGAGCAAATGGACAAAACAGACTAAAACACGTTTATATATT
L Y S D N G V F R V T S R V M F Q P R L P V L S D F V Q I Y N
Spike

TTGTAATGTTACTTTTGTAAACATATCTCGTGTGAGTTACATACTGTCTACCTGACTACGTTGATGTTAATAAAACATTACAAGAGTTTG 24104
AACATTACAATGAAAACAATTGTATAGAGCACAGCTCAATGTATGACAGTATGGACTGATGCAACTACAATTATTTTGTAAATGTTCTCAAAC
C N V T F V N I S R V E L H T V I P D Y V D V N K T L Q E F
Spike

CACAAAACCTACCAAAGTATGTTAAGCCTAATTTTGACTTGACTCCTTTTAAATTTAACATATCTTAATTTGAGTTCTGAGTTGAAGCAACTC 24196
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A O N L P K Y V K P N F D L T P F N L T Y L N L S S E L K O L
Spike

GAAGCTAAAACCTGCTAGTCTTTTCCAACTACTGTTGAATTACAAGGTCTTATTGATCAGATTAACAGTACATATGTTGATTTGAAGTTGCT 24288
CTTCGATTTGACGATCAGAAAAGGTTTGATGACAACTTAATGTTCCAGAATAACTAGTCTAATTGTCATGTATACTAACTTCAACGA
E A K T A S L F O T T V E L O G L I D O I N S T Y V D L K L L
Spike

TAATAGGTTTGAAAATTATATCAATGGCCTTGGTGGGTTTGGCTCATTATTTCTGTTGTTTTGTTGTATTGTTGAGTCTTCTGTGTTTT 24380
ATTATCCAACTTTTAAATAGTTTACCGGAACCAACCAACCGAGTAATAAGACAACAAAAACAACATAACAACCTCAGAAGAACACAAAA
N R F E N Y I K W P W W V W L I I S V V F V V L L S L L V F
Spike

GTGTCTTTCTACAGGTTGTTGTGGTTGTTGCAATTGTTTAACTTCATCAATGCGAGGCTGTTGTGATTGTGGTTCAACTAACTTCCTTAT 24472
CAACAGAAAGATGTCCAACAACCAACAACGTTAACAATTGAAGTAGTTACGCTCCGACAACCTAACCAAGTTGATTGAAGGAATA
C C L S T G C C G C C N C L T S S M R G C C D C G S T K L P Y
Spike

TATGAATTTGAAAAGGTCCACGTTCAATAATGCCTTTTCGGTGGCCTATTTCAACTTACTCTTGAAAGTACTATTAATAAGAGTGTGGCTAAT 24564
ATACTTAACTTTTCCAGGTGCAAGTTATTACGGAAGCCACCGGATAAAGTTGAATGAGAAGTTTCATGATAATTATTCTCACACCGGATTA
Y E F E K V H V Q
Spike
M P F G G L F Q L T L E S T I N K S V A N
ORF 4ab

CTCAAATTACCACCTCATGATGTTACTGTCTTGGCGTGACAATCTTAAACCTGTTACTACACTTAGTACTATCACTGCTTATTTGTTAGTTAG 24656
GAGTTTAATGGTGGAGTACTACAATGACAGAACGCACGTGTTAGAATTTGGACAATGATGTGAATCATGATAGTGACGAATAAACAATCAATC
L K L P P H D V T V L R D N L K P V T T L S T I T A Y L L V S
ORF 4ab

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L F V T Y F A L F K P L T A R G R V A C F V L K L L T L S V
ORF 4ab

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Y V P L L V L F G M Y L D S F I I F F L R C C F D S Y M L A I
ORF 4ab

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TACGGATAGAGATTATTTTAAAAAGTAAACAAAACAAGTTACAATGATTTGATACGAAGCAAAGTCCGTTTACAACCATAGAAGTGTGTTAG
M P I S N K N F S F V L F N V T K L C F V S G K C W Y L E Q S
ORF 4ab

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F Y E N R F A A I Y G G D H Y V V L G G E T I T F V S F D D
ORF 4ab

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L Y V A I R G S C E K N L Q L M R K V D L Y N G A V I Y I F A
ORF 4ab

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M F L R L I D D N G I V L N S
E
E E P V V G I V Y S S O L Y E D V P S I N
ORF 4ab

Fig. 3f: Matrix amino acid identity

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	PRCoV	OC43	PHEV	BoCoV	MHV	RaSA	AIBV	SARS
EMCR	1.000	0.615	0.650	0.441	0.429	0.400	0.437	0.317	0.317	0.317	0.303	0.303	0.239	0.286
229E	--	1.000	0.557	0.380	0.372	0.344	0.384	0.317	0.309	0.309	0.299	0.316	0.269	0.277
PEDV	--	--	1.000	0.460	0.452	0.386	0.460	0.351	0.360	0.364	0.358	0.363	0.234	0.303
TGEV	--	--	--	1.000	0.878	0.758	0.958	0.330	0.334	0.346	0.335	0.332	0.208	0.254
CaCoV	--	--	--	--	1.000	0.757	0.878	0.311	0.315	0.326	0.319	0.304	0.192	0.243
FeCoV	--	--	--	--	--	1.000	0.772	0.268	0.279	0.286	0.272	0.265	0.174	0.234
PRCoV	--	--	--	--	--	--	1.000	0.330	0.334	0.346	0.335	0.332	0.215	0.262
OC43	--	--	--	--	--	--	--	1.000	0.934	0.947	0.848	0.818	0.270	0.386
PHEV	--	--	--	--	--	--	--	--	1.000	0.943	0.848	0.818	0.270	0.400
BoCoV	--	--	--	--	--	--	--	--	--	1.000	0.870	0.839	0.278	0.391
MHV	--	--	--	--	--	--	--	--	--	--	1.000	0.938	0.271	0.382
RaSA	--	--	--	--	--	--	--	--	--	--	--	1.000	0.275	0.369
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.262
SARS	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 3g: Nucleoprotein amino acid identity

Seq->	EMCR	229E	PEDV	TGEV	FeCoV	PRCoV	CaCoV	RSDAC	MHV	PHEV	OC43	BoCoV	SARS	AIBV
EMCR	1.000	0.447	0.363	0.331	0.319	0.329	0.339	0.188	0.189	0.179	0.183	0.183	0.214	0.179
229E	--	1.000	0.345	0.333	0.304	0.326	0.330	0.194	0.202	0.192	0.194	0.192	0.203	0.181
PEDV	--	--	1.000	0.279	0.248	0.275	0.275	0.165	0.170	0.164	0.164	0.162	0.182	0.180
TGEV	--	--	--	1.000	0.761	0.963	0.897	0.220	0.221	0.203	0.205	0.203	0.234	0.196
FeCoV	--	--	--	--	1.000	0.756	0.763	0.212	0.213	0.192	0.195	0.197	0.217	0.185
PRCoV	--	--	--	--	--	1.000	0.879	0.220	0.226	0.205	0.207	0.205	0.231	0.192
CaCoV	--	--	--	--	--	--	1.000	0.216	0.220	0.199	0.201	0.199	0.217	0.199
RSDAC	--	--	--	--	--	--	--	1.000	0.894	0.693	0.697	0.697	0.293	0.208
MHV	--	--	--	--	--	--	--	--	1.000	0.680	0.684	0.682	0.290	0.216
PHEV	--	--	--	--	--	--	--	--	--	1.000	0.948	0.953	0.270	0.199
OC43	--	--	--	--	--	--	--	--	--	--	1.000	0.973	0.272	0.203
BoCoV	--	--	--	--	--	--	--	--	--	--	--	1.000	0.274	0.203
SARS	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.206
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 3h: Matrix nucleotide identity

Seq->	SARS	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	PRCoV	OC43	PHEV	BoCoV	MHV	RatSA	AIBV
SARS	1.000	0.286	0.281	0.303	0.254	0.243	0.258	0.262	0.386	0.400	0.391	0.382	0.369	0.262
EMCR	--	1.000	0.615	0.650	0.441	0.429	0.441	0.437	0.317	0.317	0.317	0.303	0.303	0.239
229E	--	--	1.000	0.557	0.380	0.365	0.376	0.380	0.321	0.313	0.313	0.303	0.320	0.269
PEDV	--	--	--	1.000	0.460	0.452	0.425	0.460	0.351	0.360	0.364	0.358	0.363	0.234
TGEV	--	--	--	--	1.000	0.878	0.836	0.958	0.330	0.334	0.346	0.335	0.332	0.208
CaCoV	--	--	--	--	--	1.000	0.835	0.878	0.311	0.315	0.326	0.319	0.304	0.192
FeCoV	--	--	--	--	--	--	1.000	0.851	0.296	0.307	0.315	0.300	0.292	0.192
PRCoV	--	--	--	--	--	--	--	1.000	0.330	0.334	0.346	0.335	0.332	0.215
OC43	--	--	--	--	--	--	--	--	1.000	0.934	0.947	0.848	0.818	0.270
PHEV	--	--	--	--	--	--	--	--	--	1.000	0.943	0.848	0.818	0.270
BoCoV	--	--	--	--	--	--	--	--	--	--	1.000	0.870	0.839	0.278
MHV	--	--	--	--	--	--	--	--	--	--	--	1.000	0.938	0.271
RatSA	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.275
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 3i: Matrix nucleotide identity

Seq->	EMCR	229E	PEDV	TGEV	FeCoV	PRCoV	CaCoV	RSDAC	MHV	PHEV	OC43	BoCoV	SARS	AIBV
EMCR	1.000	0.447	0.358	0.336	0.326	0.334	0.344	0.188	0.189	0.179	0.183	0.183	0.210	0.173
229E	--	1.000	0.336	0.335	0.304	0.328	0.333	0.196	0.204	0.187	0.190	0.188	0.199	0.173
PEDV	--	--	1.000	0.277	0.244	0.272	0.270	0.163	0.168	0.160	0.160	0.158	0.184	0.178
TGEV	--	--	--	1.000	0.761	0.963	0.897	0.220	0.223	0.200	0.202	0.200	0.232	0.192
FeCoV	--	--	--	--	1.000	0.756	0.763	0.209	0.212	0.185	0.187	0.189	0.218	0.185
PRCoV	--	--	--	--	--	1.000	0.879	0.220	0.228	0.202	0.204	0.202	0.230	0.192
CaCoV	--	--	--	--	--	--	1.000	0.215	0.221	0.196	0.198	0.196	0.216	0.196
RSDAC	--	--	--	--	--	--	--	1.000	0.894	0.693	0.697	0.697	0.285	0.200
MHV	--	--	--	--	--	--	--	--	1.000	0.680	0.684	0.682	0.282	0.208
PHEV	--	--	--	--	--	--	--	--	--	1.000	0.948	0.953	0.261	0.195
OC43	--	--	--	--	--	--	--	--	--	--	1.000	0.973	0.261	0.197
BoCoV	--	--	--	--	--	--	--	--	--	--	--	1.000	0.266	0.197
SARS	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.211
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

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E

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T V L N A S I P E S K P L A D D D S A I I E I V N E V L H 3'

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3'UTR

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3'UTR

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3'UTR

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3'UTR

Fig. 2A

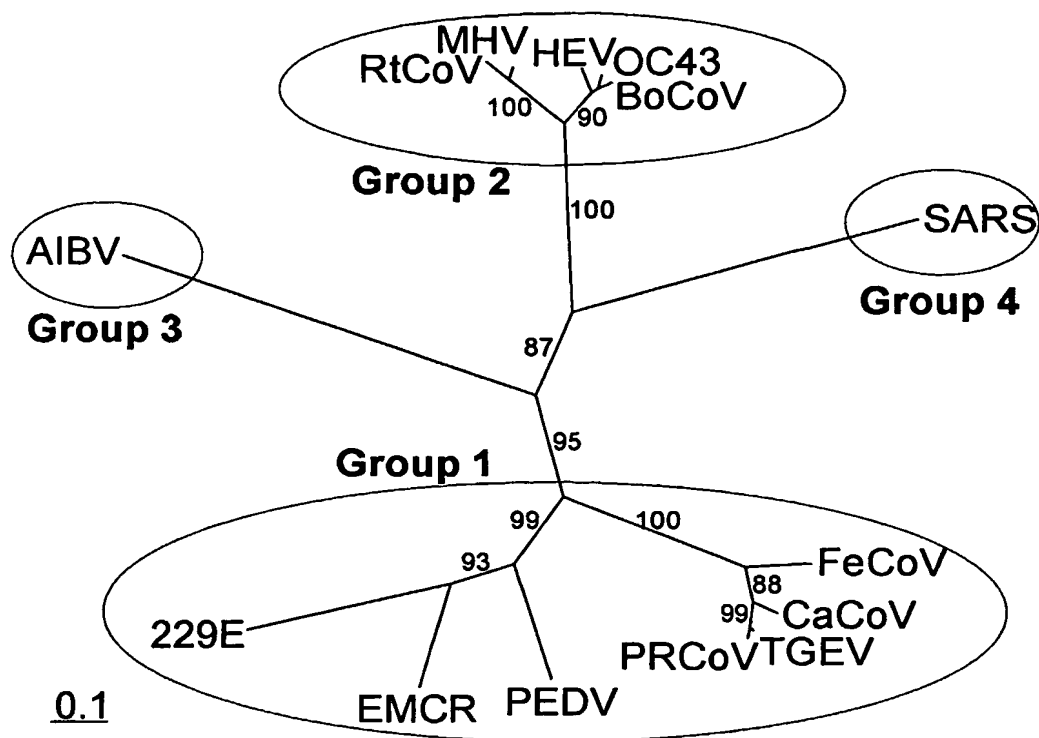


Fig. 2B

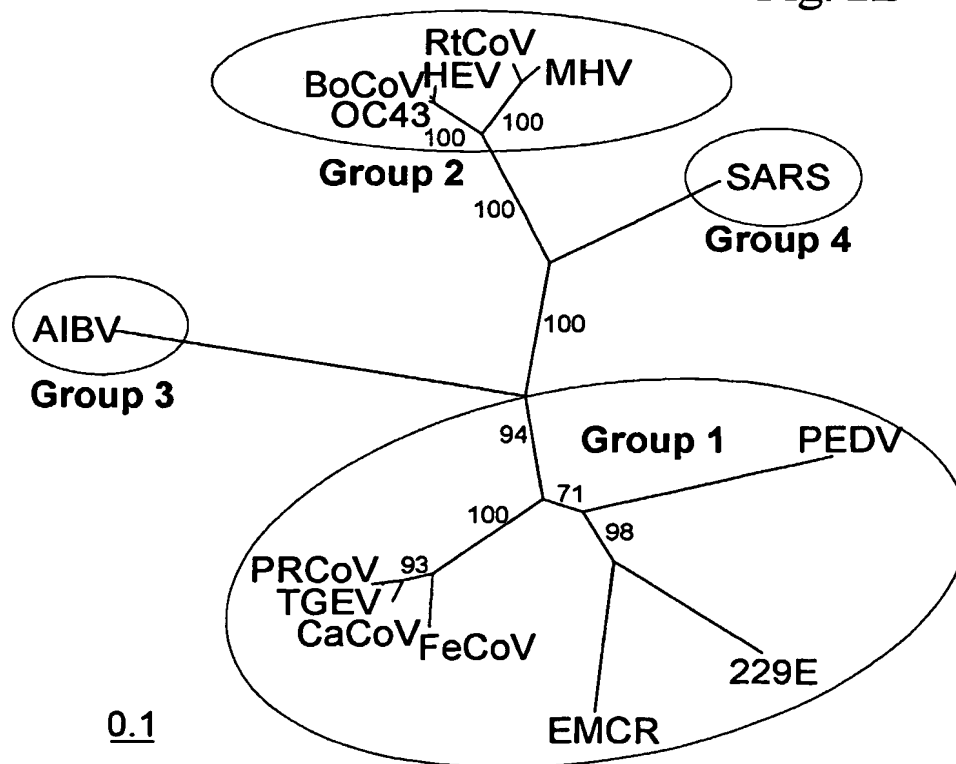


Fig. 3a: Putative Orf 1a Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	OC43	BoCoV	MHV	AIPV	SARS
EMCR	1.000	0.566	0.491	0.371	0.211	0.213	0.215	0.185	0.194
229E	--	1.000	0.475	0.379	0.211	0.211	0.209	0.191	0.194
PEDV	--	--	1.000	0.366	0.208	0.208	0.204	0.183	0.192
TGEV	--	--	--	1.000	0.204	0.204	0.199	0.182	0.186
OC43	--	--	--	--	1.000	0.964	0.656	0.182	0.255
BoCoV	--	--	--	--	--	1.000	0.659	0.186	0.255
MHV	--	--	--	--	--	--	1.000	0.178	0.253
AIPV	--	--	--	--	--	--	--	1.000	0.178
SARS	--	--	--	--	--	--	--	--	1.000

Fig. 3b: Putative Orf 1b Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	BoCoV	OC43	MHV	AIPV	SARS
EMCR	1.000	0.815	0.778	0.711	0.504	0.517	0.523	0.516	0.550
229E	--	1.000	0.765	0.720	0.504	0.520	0.515	0.515	0.546
PEDV	--	--	1.000	0.728	0.522	0.538	0.531	0.523	0.552
TGEV	--	--	--	1.000	0.517	0.533	0.529	0.520	0.551
BoCoV	--	--	--	--	1.000	0.953	0.832	0.519	0.591
OC43	--	--	--	--	--	1.000	0.857	0.534	0.611
MHV	--	--	--	--	--	--	1.000	0.532	0.606
AIPV	--	--	--	--	--	--	--	1.000	0.541
SARS	--	--	--	--	--	--	--	--	1.000

Fig. 3c: Putative Orf 1ab Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	OV43	BoCoV	MHV	AIBV	SARS
EMCR	1.000	0.666	0.605	0.503	0.314	0.310	0.316	0.314	0.326
229E	--	1.000	0.592	0.510	0.320	0.314	0.316	0.311	0.326
PEDV	--	--	1.000	0.509	0.326	0.320	0.323	0.313	0.328
TGEV	--	--	--	1.000	0.317	0.311	0.313	0.311	0.320
OV43	--	--	--	--	1.000	0.961	0.734	0.312	0.408
BoCoV	--	--	--	--	--	1.000	0.725	0.307	0.400
MHV	--	--	--	--	--	--	1.000	0.309	0.404
AIBV	--	--	--	--	--	--	--	1.000	0.312
SARS	--	--	--	--	--	--	--	--	1.000

Fig. 3d: Putative Spike protein Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	Por R	OC43	BoCoV	MHV	Rat C	PHEV	AIBV	SARS
EMCR	1.000	0.547	0.442	0.387	0.386	0.394	0.393	0.205	0.206	0.196	0.198	0.203	0.202	0.167
229E	--	1.000	0.412	0.383	0.381	0.383	0.445	0.178	0.185	0.178	0.174	0.179	0.230	0.176
PEDV	--	--	1.000	0.412	0.412	0.415	0.403	0.193	0.188	0.189	0.189	0.194	0.198	0.179
TGEV	--	--	--	1.000	0.787	0.802	0.812	0.196	0.195	0.199	0.202	0.197	0.188	0.171
CaCoV	--	--	--	--	1.000	0.911	0.743	0.196	0.195	0.202	0.202	0.194	0.184	0.167
FeCoV	--	--	--	--	--	1.000	0.758	0.195	0.193	0.197	0.200	0.196	0.188	0.167
Por R	--	--	--	--	--	--	1.000	0.183	0.185	0.189	0.191	0.186	0.212	0.164
OC43	--	--	--	--	--	--	--	1.000	0.911	0.637	0.637	0.803	0.171	0.254
BoCoV	--	--	--	--	--	--	--	--	1.000	0.642	0.643	0.817	0.173	0.255
MHV	--	--	--	--	--	--	--	--	--	1.000	0.909	0.643	0.183	0.249
Rat C	--	--	--	--	--	--	--	--	--	--	1.000	0.646	0.184	0.255
PHEV	--	--	--	--	--	--	--	--	--	--	--	1.000	0.177	0.252
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.164
SARS	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 3e: Putative Orf E Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	Por R	OC43	BoCoV	PHEV	MHV	Rat C	AIBV	SARS
EMCR	1.000	0.467	0.415	0.292	0.304	0.256	0.304	0.154	0.154	0.154	0.181	0.181	0.092	0.179
229E	--	1.000	0.532	0.243	0.231	0.243	0.231	0.214	0.214	0.214	0.227	0.227	0.120	0.230
PEDV	--	--	1.000	0.280	0.268	0.256	0.280	0.214	0.214	0.214	0.227	0.227	0.092	0.179
TGEV	--	--	--	1.000	0.914	0.743	0.963	0.172	0.172	0.172	0.172	0.172	0.145	0.228
CaCoV	--	--	--	--	1.000	0.804	0.926	0.172	0.172	0.172	0.193	0.193	0.127	0.216
FeCoV	--	--	--	--	--	1.000	0.756	0.183	0.183	0.183	0.182	0.182	0.127	0.204
Por R	--	--	--	--	--	--	1.000	0.183	0.183	0.183	0.172	0.172	0.136	0.216
OC43	--	--	--	--	--	--	--	1.000	0.976	0.988	0.644	0.655	0.119	0.176
BoCoV	--	--	--	--	--	--	--	--	1.000	0.988	0.622	0.633	0.110	0.176
PHEV	--	--	--	--	--	--	--	--	--	1.000	0.633	0.644	0.119	0.176
MHV	--	--	--	--	--	--	--	--	--	--	1.000	0.977	0.128	0.191
Rat C	--	--	--	--	--	--	--	--	--	--	--	1.000	0.128	0.202
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.137
SARS	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 4 Alignments

a. 5' untranslated region (Genomic sequence) aligned with human coronavirus 229E

	5 15 25 35 45 55
EMCR5'UTR	-----
229E5'UTR	ACTTAAGTAC CTTATCTATC TACAGATAGA AAAGTTGCCT -TTTAGACTT TGTGTCTACT

	65 75 85 95 105 115
EMCR5'UTR	CCTCTCAACT AAACGAAATT TTT-CTAGTG CTGTCATTGT TTATG--GCA GTCCTAGTGT
229E5'UTR	TTTCTCAACT AAACGAAATT TTTGCTATGG CCGGCATCTT TGATGCTGGA GTCGTAGTGT

	125 135 145 155 165 175
EMCR5'UTR	AATTGAAATT TCGTCAAGTT TGTAA-ACTG GTTAGGCAAG TGTGTATT TCTGTGTTTA
229E5'UTR	AATTGAAATT TCATTGCGGT TGCAACAGTT TGGAGCAAG TGCTGTGTGT CCTA-GTCTA

	185 195 205 215 225 235
EMCR5'UTR	AGCACTGGTG GTTCTGTC-C ACTAGTGCAC AC-ATTGATA CTTAAGT-GG TGTCTGTCTA
229E5'UTR	AGGGTTTCGT GTTCCGTCAC GAGATTCCAT TCTACAAACG CCTTACTCGA GGTTCGCTCT

	245 255 265 275 285
EMCR5'UTR	CTGCTTATTG TGGAGCAAC GTTCTGTCGT TGTGGAAACC AATAACTGCT AACC
229E5'UTR	CGTGTCTTGTG TGGAGCAAA GTTCTGTCTT TGTGGAAACC AGTAACTGCT CTA

b. Putative Orf 1a

	5 15 25 35 45 55
EMCR	-----
229E	-----
PEDV	-----
TGEV	-----
OC43	MSKINKYGLE LHWAEFPWM FEDAEKLDN PSSSEVDMIC STTAQKLETG GICPENHVMV
BoCoV	MSKINKYGLE LHWAEFPWM FEDAEKLDN PSSSEVDIVC STTAQKLETG GICPENHVMV
MHV	MAKMGKYGLE FKWAPEFPWM LPNASEKLGS PERSEEDGFC PSAAQEPKTK GKTLLNHVRV
AIPV	-----
SARS CoV	-----

	65 75 85 95 105 115
EMCR	GLQDCVTGIN DDD-YVIALT GTNQLCAKIL LFSRPLNLR GWLIFSNSNY VLQDFDVVFG
229E	DLQDCIVGIA DDT-YVMGLH GNQTLFCNIM KFSRPFMLH GWLVFSNSNY LLEEDFVVFG
PEDV	DLADTVEGLL PED-YVMVVI GTTKLSAYVD TFGSRPRNIC GWLIFSNCNY FLEELELTFG
TGEV	YCRDLVDCDR KDH-YVIGVL GNGVSDLKPV LLTEPSVMLQ GFIVRANCNG VLEDFDLKIA
OC43	DCRRLKQEC CVQSSLIREI VMNASPYDLE VLLQDALQSR EAVLVTTPLG MSLEACYVRG
BoCoV	DCRRLKQEC CVQSSLIREI VMNTRPYDLE VLLQDALQSR EAVLVTPPLG MSLEACYVRG
MHV	DCSRLPALEC CVQSAIIRDI FVDEDPLNVE ASTMALQFG SAVLVKPSKR LSIQAWAKLG
AIPV	VRQKFDRSLQ TGKQFKFETV CGLFLLKGVD KITPG----- VPAKVLKATS KLADLEDIFG
SARS CoV	NGTCGLVELE KGVLPQLEQP YVFIKRSDAL STNHGHKVVE LVAEMDGIQY GRSGITLGLV

	125 135 145 155 165 175
EMCR	--HGAGSVVF VDKYMCDFDG KPVLPKNMWE FRDYFNDNTD S-IVIGGVTY QLAWDVIRKD
229E	K-RGGGNVTY TDQYLCGADG KPVMSEDWQ FVDHFGENEE --IIINGHTY VCAWLTKRKP
PEDV	--RRGGNIVP VDQYMCADG KPVLESEWE YTDFFADSED GQLNIAGITY VKAWIVERSD
TGEV	--RTGRGAIY VDQYMCADG KPVEG---D FKDYFGDED- -IEFEGEY HCAWTTVRDE
OC43	C-NPKGWTMG LFRRRSVCNT GRCVTNKHVA YQLYMIDPAG ---VCLGAGQ FVGWVIPLAF
BoCoV	C-NPENGWTMG LFRRRSVCNT GRCVNVKHVA YQLYMIDPAG ---VCFGAGQ FVGWVIPLAF
MHV	V-LPKTPAMG LFKRFCLCNT RECVCDAHVA FQLFTVQPDG ---VCLGNR FVGWVFPVTA
AIPV	VSPLARKYRE LLKTACQWSL TVEALDVRAQ TLDEIFDPT- -EILWLQVAAK
SARS CoV	VPHVGETPIA YRNVLLRKNG NKGAGGHSYG IDLKSIDLGD ELGTDPIEDY EQNWNTKHGS

	185	195	205	215	225	235
EMCR	LSYEQQNVLA	IESIHYLG-T	TGHTLKSGCK	LINAKPPKY-	--SSKVVLSG	EWNNAVYKAFG
229E	LDYKRRQNNLA	IEEIEYVHGD	ALHTLRNGSV	LEMAKEVKT-	--SSKVVLSD	ALDKLYKVFG
PEDV	VSYASQNLTS	IKSITYCS-T	YEHTFLDGT	MKVARTPKI-	--KKNVVLSE	PLATIYREIG
TGEV	KPLNQQTFLT	IQEIQYNL-D	IPHKLPNCAT	RHVAPPVKK-	--NSKIVLSE	DYKKLYDIFG
OC43	MPVQSRKFIV	PWVMYLRKRG	EKGAYNKDHG	RGFGH----	--VYDFKVED	AYDQVHDEPK
BoCoV	MPVQSRKFIA	PWVMYLRKCG	EKGAYIKDYK	RGGFEH----	--VYNFKVED	AYDLVHDEPK
MHV	IPAYAKQWLQ	PWSILLRKGG	NKGSVTSGHF	RRAVTMP---	--VYDFNVED	ACEEVHLNPK
AIPV	IHVSSMAMRR	LVGEVTAKVM	DALGSNLSAL	FQIVKQ----	--QIARIFQK	ALAI FENVNE
SARS CoV	GALRELTREL	NGGAVTRYVD	NNFCGPDGYP	LDCIKDFLAR	AGKSMCTLSE	QLDYIESKRG

	245	255	265	275	285	295
EMCR	SPFITNGISL	LDIIVKPVFF	NAFVKNCNGS	ENWSVGAWDG	YLSSCCGTPA	KKLCVVPGNV
229E	SPVMTNGSNI	LEAFTKPVFI	SALVCTCTCGT	KSWSVGDWGT	FKSSCCNVIS	NKLCVVPGNV
PEDV	SPFVDNGSDA	RSIIRPVFL	HAFVKCKCGS	YHWTVDWTS	YVSTCCGFKC	KPVLVASC SA
TGEV	SPFMGNGDCL	SKCFDTLHFI	AATLRSCPGS	ESSGVGDWGT	EKTACGLSG	KVKGVTLGDI
OC43	GKFSKKAYAL	IRGYRGVKPL	LYVDQYGC DY	TGSLADGLEA	YADKTLQEMK	ALFPTWSQEL
BoCoV	GKFSKKAYAL	IRGYRGVKPL	LYVDQYGC DY	TGGLADGLEA	YADKTLQEMK	ALFPPIWSQEL
MHV	GKYSRKAYAL	LKGYRGVKSI	LFLDQYGC DY	TGRLAKGLED	YGDCTLEEMK	ELFPVWCD SL
AIPV	LPQRIAAALM	AFAKARSIT	VVVVERTLVV	KEFAGTCLAS	INGAVAKFFE	ELPNGFMGSG
SARS CoV	VYCCRDHEHE	IAWFTERSDK	SYEHQTPFEI	KS--AKKFDT	FKGECPKFVF	PLNSKVKVIO

	305	315	325	335	345	355
EMCR	VPGDVIITST	DAGCGVKYYA	GLVVKHITNI	TGVSLWRVTA	VHSDGMFVAT	SSYDALLHRN
229E	KPGDAVITQ	QAGAGIKYCF	GMTLKFVANI	EGVSVWRVIA	LQSVDCFVAS	STFVEEHEVN
PEDV	MPGSVVVTRA	GAGTGKYYN	NMFLRHVADI	DGLAFWRILK	VQSKDDLACS	GKFLEHHEEG
TGEV	KPGDAVVTSM	SAGKGKFFFA	NCVLQYAGDV	EGVSIWKVIK	TFTVDET VCT	PGFEGLN--Y
OC43	LFDDVIAVHV	VRDP----RY	VMRLQSAATI	R---SVAYVA	NPTEDLCDGS	VVIKEPVHVV
BoCoV	PFDDVIAVHV	VRDP----RY	VMRLQSAATI	R---SVAYVA	NPTEDLCDGS	VVIKEPVHVV
MHV	DNEVVVAVHV	DRDP----RA	VMRLQTLATI	R---SIGYVG	QPTEDLV DGD	VVVREPAHLL
AIPV	IFTTLAFFKE	AAVR-----	-VVENIPNAP	RGTGKFEVVG	NAKGTQVVVR	GMRNDLTLLD
SARS CoV	PRVEKKKTEG	FMGRIRSVYP	VAS PQECNNM	HLSTLMKCNH	CDEVSWQTC D	FLKATCEHCG

	365	375	385	395	405	415
EMCR	SLDPFCFDVN	TLLSNQLRLA	FLGASVTE DV	KFAASTGVID	ISAGMFGLYD	DILTNNKPWF
229E	RMDTFCFNVR	NSVTDECLRA	MLGAEMTSNV	RRQVASGVID	ISTGWFDVYD	DIFAESKPWF
PEDV	FTDPCYFLND	SSLATKLKFD	ILSGKFSDEV	KQAI IAGHVV	VGSALVDIVD	DALG--QPWF
TGEV	--DFIKPESK	SLVACSVKRA	FITGDI DDAV	HDCIITGKLD	LSTNLFNGVNG	LLFKK--TPWF
OC43	ADDSIILRQY	NLVDIMSHFY	MEADTVVNAF	YGVALKDCGF	VMQFGYIDCE	QDSCDFKGWI
BoCoV	ADDSIILRQH	NLVDIMSCFY	MEADAVVNAF	YGVDLKDCGF	VMQFGYIDCE	QDCLCDFKGWV
MHV	AANAIVKRLP	RLVETMLYT-	--DSSVTEFC	YKTKLDCDCGF	ITQFGYVDCC	GDACDFRGWV
AIPV	QKADIPVEPE	GWSAILDGHL	CYVFRSGDRF	YAAPLSGNFA	LSDVHCCERV	VCLSDGVTPE
SARS CoV	-TENLVIEGP	TTCGYLPTNA	VVKMPCPACQ	DPEIGPEHSV	ADYHNHSNIE	TRLR--KGGR

	425	435	445	455	465	475
EMCR	VRKASGLFDA	IWDAFVAAIK	LVPTTGGGLV	RFVKSIASTV	LTVSNGVIIIM	CADVPDAFQP
229E	VRKAEDIFGP	CWSALASALK	QLKVTTGELV	RFVKSICNSA	VAVVGGTIQI	LASVPEKFLN
PEDV	IRKLGDLASA	PWEQLKAVVR	GLGLLSDEVV	LFGKRLSCAT	LSIVNGVFEF	LADVPEKLAA
TGEV	VQKCGALFVD	AWKVVEELCG	SLTLTYKQIY	EVVASLCTSA	FTIVNYKPTF	VVPD--NRVKD
OC43	PGNMIDGFAC	TTCGHVYEVG	DLIAQSSGVL	PVNPVLHTKS	AAGYGG----	--FGCKDSFTL
BoCoV	PGNMIDGFAC	TTCGHVYETG	DLIAQSSGVL	PVNPVLHTKS	AAGYGG----	--FGCKDSFTL
MHV	PGNMMIDGFLC	PGCSKSYMPW	ELEAQSSGVI	PKGGVLF TQS	TDTVN-----	----RESFKL
AIPV	INDGLILAAI	YSSFSVSELV	TALKKGEPFK	FLGHKFVYAK	DAAVS-----	-----FTL
SARS CoV	TRCFGGCVFA	YVGCYNKRAY	WVPRASADIG	SGHTGITGDN	VETLN-----	--EDLLEILS

	485	495	505	515	525	535
EMCR	VYRTFTQAIC	AAFDFSLDVF	KIG---DVKF	KRLGDYVLTE	NALVRLTTEV	VRGVRDARIK
229E	AFDVFETAIQ	TVFDCAVETC	TIA---GKAF	DKVFDYVLLD	NALVKLVTTK	LKGVREGRGN
PEDV	AVTVFVNFLN	EFFESACDCL	KVG---GKTF	NKVGSYVLF D	NALVKLVKAK	ARGPRQAGIC
TGEV	LVDKCKVKVLG	KAFDVF TQII	TIAGIEAKCF	VLGAKYLLFN	NALVKLVSVK	ILGKKQKGLE
OC43	YGQTVVYFVG	CVYWSPARNI	WIP--ILKSS	VKSYSLSLVY	GVLGCKAIVK	ETNLICKALY
BoCoV	YGQTVVYFVG	CVYWSPARNI	WIP--ILKSS	VKSYSLSLVY	GVVGCKAIVK	ETNLICKALY
MHV	YGHAVVPFGS	AVYWSYPYPM	WLP--VIWSS	VKSADLT YT	GVVGCKAIVQ	ETDAICRSLY
AIPV	AKAATIADVL	RLFQSARVIA	EDVWS-SFTE	KSFEFWKLAY	GKVRNLEEFV	KTYVCKAOMS
SARS CoV	REARNINIVG	DLHLNEEVAI	ILAS-FSAST	SAFIDTIKSL	DYKSFKTIVE	SCGNKYVTKG

	545	555	565	575	585	595
EMCR	KAMFTKV VVG	PTTEVKFSVI	ELATVNLRLV	DCAPVVC PKG	KIVVIAGQAF	FYSGGFYRFM
229E	KVKYATV VVG	STTEVKSSRV	ERSTAVLTIA	NNYSKLFDEG	YTVVIGDVAY	FVSDGYFR LM
PEDV	EVRYTSLVVG	STTKVVS KRV	ENANVNLLVV	DEDVTLNTTG	RTVVVDGLAF	FESDGFYRHL
TGEV	CAFFATSLVG	ATVNVTPKRT	ETATISLNKV	DDVVABG-EG	YIIVIGDMAF	YKSGEYFMM
OC43	LDYVQHKCGN	LHQRELLGVS	DVWHKQLLLN	RGVYKPLEEN	IDYFNMRRAK	FSLETFTVCA
BoCoV	LDYVQHKCGN	LHQRELLGVS	DVWHKQLLLN	RGVYKPLEEN	IDYFNMRRAK	FSLETFTVCA
MHV	MDYVQHKCGN	LEQRAILGLD	DVYHRLQLLVN	RGDYSLLLEN	VDLFVKRRAE	FACK-FATCG
AIPV	IVILA AVLGE	DIWHLV SQVI	YKLGVLFTKV	VD FCDKHWK G	FCVQLKRAKL	IVTETFCVLK
SARS CoV	KPVKGAWNIG	QORSVLTPLI	GFPSQAGVI	RSIFARTLDA	ANHSIPDLQR	AAVTILDGIS

	605	615	625	635	645	655
EMCR	VDSTTVLNNDP	VFTGELFYTI	KFSGFKLDGF	N-----H	QFVNASSATD	AIIAVELLLS
229E	ASPNSVLTTA	VYKPLFAFNV	NVMGTRPE--	-----	KFPTTVTCEN	LESAYLVFND
PEDV	ADADVIEHP	VYKSACELKP	VFECDDIP--	D-----F	PLPVAASVAE	LCVQTDLLLK
TGEV	SSPNFVLNN	VFKAVKVPSY	DIVYDVNDT	KSKMIAKLS	SFEYDGDIDA	AIVKVNELLI
OC43	DGFMPFLDD	LVPRAYYLAV	SGQAFCDY--	-----	ADKLCHAVVS	KSKELLDVSL
BoCoV	DGFMPFLDD	LVPRAYYLAV	SGQAFCDY--	-----	AGKICHAVVS	KSKELLDVSV
MHV	DGLVPLLDG	LVPRSYLIK	SGQAFCTSM--	-----	MVNFSHEVTD	MCMDMALLFM
AIPV	GVAQHCFQLL	LDATHSLYKS	FKKCALGR--	-----	---IHGDLF	WKGGVHKIVQ
SARS CoV	EQSLRLVDAM	VYTSDLLTNS	VIIMAYVTG--	-----	--GLVQQTQ	WLSNLLGTTV

	665	675	685	695	705	715
EMCR	DFKTAVFVYT	CVVDGCSVIV	RRDAT-FATH	VCFKDCYSIW	EQFCIDNCGE	PWFELTDYNAI
229E	KITEFQLDYS	IDVIDNEIIV	KPNIS-LCVP	LYVRDYVDKW	DDFCRQYSNE	SWFEDDYRAF
PEDV	NYNTPYKTS	CVVRGDKCCI	TCTLQ-FKAP	SYVEDAVN-F	VDLCTKNIGT	AGFHEFYITA
TGEV	EFRQSLCFR	AFKDDKSIIV	EAYFKKYKMP	ACLAKHIG-L	WNIKKDSCK	RGFLNLFNHL
OC43	DSLGAIIHYL	NSKIVDLAQH	FSDFG----	TSFVSKIVHF	FKTFTTSTAL	AFAWVLHFHL
BoCoV	DSLGAIIHYL	NSKIVDLAQH	FSDFG----	TSFVSKIVHF	FKTFTTSTAL	AFAWVLHFHL
MHV	HDVKVATKYV	KKVTGKLAVR	FKALG----	VAVVRKITEW	FDLAVDTAAS	AAGWLCYQLV
AIPV	DGDEIWFDAI	DSVDVEDLGV	VQEKs---ID	FEVCDDVTLP	ENQFGHMQI	EDDGKNYMEF
SARS CoV	EKLRFIFEWI	EAKLSAGVEF	LKDAW----	EILKFLITGV	FDIVKGQIQV	ASDNIKDCVK

	725	735	745	755	765	775
EMCR	LQSNPNQCAI	VQASESK--V	LLERFLPKCP	EILLSIDGHI	LWNLFVEKFN	FVTDWLKTLK
229E	ISVLDITDAA	VKAAESK--A	FVDTIVPPCP	SILKVIDGGK	IWNGVIKNVN	SVRDWLKSLLK
PEDV	HEQQDLQGF	TTCCTMSGFE	CFMPTIPQCP	AVLEEIDGGS	IWRSFITGLN	TMWDFCKRLK
TGEV	NLEDEIKETN	IOAIKN----	-----ILCP	DPLDLDYGA	IWYNCMPGCS	DP-SVLGSVQ
OC43	HGAYIVVESD	IYFVKN----	-IPRYASAVA	QAFQSVAKV	LDSLRTVTFID	GLSCFKIGRR
BoCoV	HGAYIVVESD	IYFVKN----	-IPRYASAVA	QAFQSVAKV	LDSLRTVTFID	GLSCFKIGRR
MHV	NGLFAVANGG	ITFLSD----	-VPELVKNFV	DKFKVFEKVL	IDSMSVSLS	GLTVVKTASN
AIPV	RFKKDENIYY	TPMSQLG---	---AINVVCK	AGGKTVTFG-	---ETTQVEIP	PPDVVPIKVS
SARS CoV	CFIDVVNKAL	EMCIDQ----	-----VTIAG	AKLRLNLGE	VFIAQSKGLY	RQCIRGKEQL

	785	795	805	815	825	835
EMCR	LTLTSGNLLG	NCAKRFRRVL	VKLLDVYNGF	LETVCSSVHT	AGVCIKYYAV	NVP-YVVISG
229E	LNLTQQGLLG	TCAKRFKRWL	GILLEAYNAF	LDTVVSTVKI	GGLTFKTYAF	DKP-YIVIRD
PEDV	VSGGLDGIVV	TVARFKRLG	ALLAEMYNTY	LSTVVENLVL	AGVSFKYYAT	SVP-KIVLGG
TGEV	LLING--VK	VVCDGCKGFA	NQLSKGYNKL	CNAARNDIEI	GGIPFSTFKT	PTNTFIEMTD
OC43	RICLSGRKIY	EVERGLLHSS	QLPLDVYDLT	MPSQVQKAKQ	KPIYLKSGSG	DFSLADSVVE
BoCoV	RICLSGSKIY	EVERGLLHSS	QLPLDVYDLT	MPSQVQKTKQ	KGIYLKSGSG	DFSLADSVVE
MHV	RVCLAGCKVY	EVVQKRLSAY	VMPVGCNEAT	C-----	---LVGEIE	PAVVEDDVVD
AIPV	IECCGEPWNT	IFKKAYKEPI	EVDTDLTVEQ	LLSVIYEKMC	DDLKLFPEAP	EPPPFENVAL
SARS CoV	QLLMPLKAPK	EVTFLEGDSH	DTVLTSEEVV	LKNGELEALE	TPVDSFTNGA	IVGTPVCVNG

	845	855	865	875	885	895
EMCR	FVSRVIRRR	CD--VTFFCV	SCVTFFYEFL	DTCFGVSK--	--PNAIDVEH	LELKETVFVE
229E	IVCKVENKTE	AEWIELFPHN	DRIKSFSTFE	SAYMPIAD--	--PTHFDIEE	VELLDAEFVE
PEDV	CFHSVKSVA	SV--FQIPVQ	AGIEKFVKVL	NCVHPVV--	--PRVIETSF	VELEETTFKP
TGEV	AIYSVIEQGL	AL-----	S-----FR	DADVPVVDNG	TISTADWSEP	ILLEPAEYVK
OC43	VVTSLTPCG	YS-----EPP	KVADKICIVD	NUYMAKAGDK	YYPVVVD-DH	VGLLDQAWRV
BoCoV	VVTSLTPCG	YS-----EPP	KVADKICIVD	NUYMAKAGDK	YYPVVVD-GH	VGLLDQAWRV
MHV	VVKAPLTYQG	CC-----KPP	TSFEKICVVD	KLYMAKGDQ	FYPVVVDNDT	IGVLDQCWRF
AIPV	VOKNGKDLDC	IKS-----	-----CHLI	YRDYESD--	-----DD	IEEEDAEEDC
SARS CoV	LMLLEIKDKE	QY-----	-----CALS	PGLLATN--	-----NV	FRLKGGAPIK

	905	915	925	935	945	955
EMCR	PKDGGQFFVS	DDYLWYVV-D	D-----IY	YPASCNGVLP	VAFTKLAGGK	---ISFSDDV
229E	PGCGGILAVI	DEHVIFYKK-D	G-----VY	YPSNGTNILP	VAFTKAAGGK	---VSFSDDV
PEDV	PALNGGIAIV	DGFAFYD-G	T-----LY	YPTDGNVSVV	ICFKKKGGGD	---VKFSDEV
TGEV	PKNNGNVIVI	AGYTFYKDED	E-----HF	YPYGFGRKIV	RMYNKMGGGD	KT-VSFSEEV
OC43	PCAGRRVTFK	EQPTVKEIIS	MPKIIKVFYE	LDNDFNTILN	TACGFVEVDD	TVDMEEFYAV
BoCoV	PCAGRCVTFK	EQPTVNEIAS	TPKTIKVFYE	LDKDFNTILN	TACGFVEVDD	TVDMEEFYAV
MHV	PCAGKVEFN	DKPKVKEIPS	T-RKIKINFA	LDATFDSVLS	KACSEFEVDK	DVTLDELDDV
AIPV	TDSGEAEEDC	TNSECEEEDE	D-----TK	VLALIQDPAS	IKYPLPLEDD	YS-VYNGCIV
SARS CoV	GVTFGEDTVW	EVQGYKNVRI	T-----FE	LDERVDKVLN	EKCSVYTVES	GTEVTEFACV

	965	975	985	995	1005	1015
EMCR	IVHDVEPTHK	VKLIFEFEED	-VVTSLCKKS	FGKSIIYTG-	DWEGLHEVLT	SAMNVIG---
229E	EVKDIEPVYR	VKLCFEFEDE	-KLVDVCEKA	IGKKIKHEG-	DWDSFCKTIQ	SALSVS---
PEDV	SVKTIIDPVYK	VSLEFEFESE	-TIMAVLNKA	VGNRIKVTG-	GWDDVVEYIN	VAIEVLK---
TGEV	DVQEIAPVTR	VKLEFEFDNE	-IVTGVLERA	IGTRYKETGT	TWEEFEESIS	EELDAIFDTL
OC43	VIDAIEEKL	PCKELEGVGA	-KVSFLQKL	EDNPLFLFD-	---EAGEEVLA	PKLYCAFTAP
BoCoV	VIDAIEEKL	PCKELEGVGA	-KVSFLQKL	EDNPLFLFD-	---EAGEEVLA	PKLYCAFTAP
MHV	VLDVESTLS	PCKEHDVIGT	-KVCALLNRL	AEDYVYLF-	---EGGEEVIA	PKMYCSFSAP
AIPV	HKDALDVVNL	PSGEETFFVN	NCFEGAVKPL	PQKVVDVLG-	---DWGEAVDA	QEQLCQ---
SARS CoV	VAEAVVKTQ	PVSDLLTN--	---MGIDLDEW	SVATFYLF-	---DAGEENFS	SRMYCSFYPP

	1025	1035	1045	1055	1065	1075
EMCR	--QHIKLPQF	YIYDEEGGYD	VSKP--VMIS	QWPISDDSDG	CVVEASTDFH	Q--LESVREE
229E	--CYVNLPTY	YIYDEEGGND	LSLP--VMIS	EWPLSVQQAQ	QEATLPDIAE	D--VVDQVEE
PEDV	--DHVEVPKY	YIYDEEGGTD	PNLP--VMVS	QWPLNDDTIS	QDLLDVEVVT	DAPIDSEGDE
TGEV	ANQGVLELEG	FIYDTCGGFD	IKNPDGIMIS	QYDINITADE	KSEVSASSE	EE--VESVEED
OC43	EDDDFLEESD	VEEDDVEGEE	TDLTPTSAGQ	PCVASEQEE	SEVLEDTLDD	GPSVETSDSQ
BoCoV	EDDDFLEESG	VEEDDVEGEE	TDLTPTSAGE	PCVASEQEE	SEILEDTLDD	GPCVETSDSQ
MHV	DDEDCAADV	VDADENQGGD	ADDSAALVTD	TQEDDGVAKG	QVGVAESDAR	LDQVEAFDIE
AIPV	--EPLQHTFE	EPVENSTGSS	KTMTEQVVVE	DQELPVVEQD	QDVVVYTPTD	LEVAKETAEE
SARS CoV	DEEEEDDAEC	EEEEIDETCE	HEYGTEDDYQ	GLPLEFGASA	ETVRVEEEEE	EDWLDDTTEQ

	1085	1095	1105	1115	1125	1135
EMCR	VD-----	-----	-----	-----IIE	QPFGEVEHAL	SIRQ-----
229E	VNS-----	-----	-----	-----IFD	IETVDVKHDV	S-----
PEDV	VDSSAPEKVA	-----D	VANSEPGDDG	LPVAPETNVE	SEVEEVAATL	SFIKDTPTSTV
TGEV	PENEIVEASE	GAEGTSSQEE	VETVEVADIT	STEEDVDIVE	VSAKDDPWAA	AVDVQEAQF
OC43	VEEDVEMS--	-----DFVDL	ESVIQD----	-----	--YENVCFEF	YTT-----
BoCoV	VEEDVQMS--	-----DFGDL	ESVIQD----	-----	--YENVCFEF	YTT-----
MHV	KVEDPILN--	-----ELSAE	LNAPADK----	-TYEDVLAFD	AIYSEALSAF	YAVP-----
AIPV	VD-----	-----	-----	-----	-----	-----
SARS CoV	SEIEPEP----	-----	-----	-----E	PTPEEPVNQF	TG-----

	1145	1155	1165	1175	1185	1195
EMCR	---PFSFSFR	DELGVRVLDQ	SDNNCWISTT	LIQLQLTKLL	DDSIEMQLFK	VGKVDSIVQK
229E	---PFEMPFE	ELNGLKILKQ	LDNNCWVNSV	MLQIQLTGIL	DGDYAMQFFK	MGRVAKMIER
PEDV	TKDPFAFDFV	SYGGLKVLRO	SHNNCWVTST	LVQLQLLGIV	DDP--AMELFS	AGRVGPMVRK
TGEV	NPSLPFFKTT	NLNGKILKQ	GDNNCWINAC	CYQLQAFDFE	NNE--AWEKFK	KGDVMDVFNL
OC43	-----EPEFV	KVLGLYVPKA	TRNNCWLRVS	LAVMQKLPCQ	FKD--KNLQD	LWVLYKQQYS
BoCoV	-----EPEFV	KVLGLYVPKA	TRNNCWLRVS	LAVMQKLPCQ	FKD--KNLQD	LWVLYKQQYS
MHV	-----GDETHF	KVCGFYSPAI	ERTNCWLRST	LIVMQSLPLE	FKD--LEMOK	LWLSYKSSYN
AIPV	-----	EFILIFAVPK	EEVVSQKQGA	QIKQEPQV	KPQ--REKKA	KKFKVKPATC
SARS CoV	-----YKLKTD	NVAIKCVDIV	KEAQSANPMV	IVNAANIHLK	HGGGVAGALN	KATNGAMQKE

	1205	1215	1225	1235	1245	1255
EMCR	CYELSHLISG	SLGDSGKLLS	ELLKDRYTC	ITFEMSCDCG	KKFDEQVGL	FWIMPYTKLF
229E	CYTAEQCIRG	AMGDVGLCMY	RLKDLHTGF	MVMDYKCSCT	SGRLEESGAV	LFCTPTKKAF
PEDV	CYESQKAILG	SLGDVSACLE	SLTKDLHTLK	ITCSVVCSCG	TGERIYEGCA	FRMTPTLEPF
TGEV	CYAAATTLARG	HSGDAEYLL	LMLNDYSTAK	IVLAACKGCG	EKEIVLERAV	FKLTPLKESF
OC43	QLFVDTLVNK	IPANIVLPQG	GYVADFAYWF	LTLCDWQCVA	YWKCIKCDLA	LKLKGLDAMF
BoCoV	QLFVDTLVNK	IPANIVLPQG	GYVADFAYWF	LTLCDWQCVA	YWKCIKCDLA	LKLKGLDAMF
MHV	KEFVDKLVKS	VPKSIILPQG	GYVADFAYFF	LSQCSFKAYA	NWRCLKCDMD	LKLQGLDAMF
AIPV	EKPKFLEYKT	CVGDLTVVIA	KALDEFKEFC	IVNAANEHMT	HGSGVAKAIA	DFCGLDVEY
SARS CoV	SDDYIKLNGP	LTVGSGCLLS	GHNLAACKLH	VVGPNLNAGE	DIQLLKAAYE	NFNSQDILLA

	1265	1275	1285	1295	1305	1315
EMCR	KQGECCICHK	MQTYKLVSMSK	GTGVFQD--	PAPIDIDAFP	VRPICSSVYL	GVKSGSHYQT
229E	PYGTCLNCNA	PRMCTIRQLQ	GTIIFVQOK-	PEPVNPVSFV	VKPVCSIFR	GAUSCGHYQT
PEDV	PYGACAQCAQ	VLMHTFKSIV	GTGIFCRD--	TTALSLSLV	VKPLCAAAFI	GK--DSGHYVT
TGEV	NYGVCDCMQ	VNTCRFLSVE	SGSVFVHDIL	SKQTPEAMFV	VKPVMHAVYT	GTQNGHYMV
OC43	FYGDVVSHIC	KCGESMVLID	VDVPFTAFA	LKDKLFCAFI	TKRIVYKAAC	VVDVNDSHSM
BoCoV	FYGDVVSHVC	KCGESMVLID	VDVPFTAFA	LKDKLFCAFI	TKRSVYKAAC	VVDVNDSHSM
MHV	FYGDVVSHVC	KCGTGMTLLS	ADIPYTLHFG	LRDDKFCAFY	TPRKVFRAAC	VVDVNDCHSM
AIPV	CEDYVKKHGP	QORLVTPSFV	KGIQCVNNV	GPRHGDNNLH	EKLVAAYKNV	LVDGVNVVYV
SARS CoV	PLLSAGIFGA	KPLQSLQVCV	QTVRTQVYIA	VNDKALYEQV	VMDYLDNLKP	RVEAPKQEEP

	1325	1335	1345	1355	1365	1375
EMCR	NLYSFDKAID	GFGVFDIK--	-----	-----NSSV	NTVCFVDVDF	HS--VEIEAGE
229E	NIYSQNLQVD	GFGVNIQIP-	-----	-----WTNDAL	NTICIKDADY	NAKVEISVTP
PEDV	NFYDAAMAID	GYGRHQIK--	-----	-----YDTL	NTICVKDVNW	TAPLVPVADS
TGEV	DDIEHGYCVD	GMGIKPLKKR	CYTSTLFINA	NVMTRAEEKPK	QEFKVEKVEQ	QPIVEENKSS
OC43	AVVDG-KQID	DHRITSIT--	-----	-----SDK	FDFIIGHGMS	FSMTTFEIAQ
BoCoV	AVVDG-KQID	DHRITSIT--	-----	-----SDK	FDFIIGHGMS	FSMTTFEIAQ
MHV	AVVDG-KQID	GKVVTKFN--	-----	-----GDK	YDFMVGHGMA	FSMSAFEIAQ
AIPV	PVLSLGIFGV	DFKMSIDAMR	-----	-----EA	FEGCTIRVLL	FSLSQEHIDY
SARS CoV	PNTEDSKTEE	KSVVQKPVVDV	KP-----	--KIKACIDE	VTTTLEETKF	LTNKLFLFAD

	1385	1395	1405	1415	1425	1435
EMCR	VK-----	-----	PFAYVKNVKE	YLGDISHLVN	CVSFDFFVNA	ANENLMHGGG
229E	IKNTVDTPPK	EEFVVKEKLN	AFLVHNDVAF	YQGDVDTVVN	GVDFDFIVNA	ANENLAHGGG
PEDV	VVEP-----	-----VVK	PFFYSYKNVDF	YQGDVDTVVN	-LPCDFVNA	ANEKLSHGGG
TGEV	IEKEEIQSPK	ND----DLIL	PFFYKAGKLSF	YQGDVDTVVN	FLEPDVIVNA	ANGDLKHMGG
OC43	LYG-----	-----	-SCITPNVCF	VKGDIKVS	LVAEIVVNP	ANGHMAHGGG
BoCoV	LYG-----	-----	-SCITPNVCF	VKGDIKVS	RVKAEIVVNP	ANGHMAHGGG
MHV	LYG-----	-----	-SCITPNVCF	VKGDIKVS	RVKAEIVVNP	ANGHMAHGGG
AIPV	FD-----	-----	-----VTC	KQKTIYLTED	GVKYRSIVLK	PGDSLGGFGG
SARS CoV	INGKLYHD--	-----SQ	NMLRGEDMSF	LEKDAYMVG	DVITSGDITC	VVIPSCKKAG

	1445	1455	1465	1475	1485	1495
EMCR	VARAIDILTE	GQLQSLSKDY	ISSNGPLKVG	AGVMLE--CE	KFNVENNVGP	RTG---KHEH
229E	LAKALDVYTK	GKLQRLSKEH	IGLAGKVKVG	TGVMVE--CD	SLRIFNVVGP	RKG---KHER
PEDV	IAKAIDVYTK	GMLQKCSNDY	IKAHGPIKVG	RGVMLE--AL	GLKVENNVGP	RKG---KHAP
TGEV	VARAIDVFTG	GKLTERSNDY	LKKNKSIAPG	NAFFENVIE	HLSVLNAVGP	RNGD--SRVE
OC43	VAKAIAVAG	QQFVKETTDM	VKSKGVCATG	DCYVSTGGKL	CKTVLNVVGP	DARTQKQSY
BoCoV	VAKAIAVAG	QQFVKETTDM	VKSKGVCATG	DCYVSTGGKL	CKTVLNVVGP	DARTQKQSY
MHV	VAGAIKAAG	KSFIKETADM	VKNQVCQVG	ECYESTGGNL	CKTVLNVVGP	DARGHGKQCY
AIPV	VYAKNKIVFT	ADDVEDKEIL	YVPTDKSIL	EYGLD---A	QKYVIYQLTL	AQKWNVQYRD
SARS CoV	TTEMLSRALK	KVPVDEYITT	YPGQGCAGYT	LEEAKTALKK	CKSAFYVLPS	EAPNAKEEIL

	1505	1515	1525	1535	1545	1555
EMCR	SLLVAYNSI	LF---ENGIP	LMPLISCGIF	GVRIENSLKA	LFSCDINKPL	QVFVYSSNEE
229E	DLLIKAYNTI	NN---EQGTP	LTPLISCGIF	GIKLETSLEV	LLDVCNTKEV	KVFVYTDTEV
PEDV	ELLVKAYKSV	FA---NSGVA	LTPLISVGIF	SVPLEESLSA	FLACVGDRHC	KCFYGDKER
TGEV	AKLCNVYKAI	AK---CEGKI	LTPLISVGIF	NVRLETSLOC	LLKTVNDRLG	NVFVYTDQER
OC43	VLLERVYKHL	N---NYDCV	VTTLSAGIF	SVPSDVSLTY	LLGTAKKQV	LVSNNQEDFD
BoCoV	ALLERVYKHL	N---KYDCV	VTTLSAGIF	SVPSDVSLTY	LLGTAKKQV	LVSNNQEDFD
MHV	SFLERAYQHI	N---KCDDV	VTTLSAGIF	SVPTDVSLTY	LIGVVTKNVI	LVSNNKDDFD
AIPV	NFLILEWRDG	N---CWISS	AIWLQAQAI	RFKGFLEAW	AKLLGGDPTD	FVAVCYASCT
SARS CoV	GTVSNWLRM	LAHAETRKL	MPICMDVRAI	MATIQKRYKG	IKIQEGIVDY	GVRFFFTSK

	1565	1575	1585	1595	1605	1615
EMCR	QAVLKFLDGL	DLTPVID---	-----DVDV	-----KPFVVEGNF	SFFDCG---V	-----
229E	CKVKDFVSG	VNVQKVE---	-----QPKIE	PKPVSVIKVA	PKPYRVDGKF	SYFTED---L
PEDV	EAIKYMDDL	VDAIFKEALV	DTTPQEDVQ	QVSQKPVLPN	FEPFRIEGAH	AFYECNPEGL
TGEV	QTIENFFS---	-----	-----	-----	-----	-----
OC43	LISKQITAV	EG-----	-----	-----	-----	-----T
BoCoV	LISKQITAV	EG-----	-----	-----	-----	-----T
MHV	VIEKQVTSI	AG-----	-----	-----	-----	-----T
AIPV	AKVGFSDAN	-----	-----	-----	-----	-----
SARS CoV	EPVASIITKL	N-----	-----	-----	-----	-----S

	1625	1635	1645	1655	1665	1675
EMCR	NALDGD-IYL	LFTNSILMLD	KQGQLLDTKL	NGILQAVLD	YLATVKTVP	GNLVKLVE-
229E	LCVADDPKIV	LFTDSMLTLD	DRGLADNAL	SGVLSAAIKD	CVDINKAIPS	GNLIKFDIG-
PEDV	MLGAD-KLV	LFTNSNLDFC	SVGKCLNDVT	SGALLEAINV	FKKSNTKTPA	GNCVTLDCAN
TGEV	-----	-----	-----	-----	-----	-----
OC43	KKLAARLSFN	VGRSIVYETD	ANKLILIN--	-DVAFVSTFN	VLQDVLSLRH	DIALDDDART
BoCoV	KKLAARLSFN	VGRSIVYETD	ANKLILIN--	-DVAFVSTFN	VLQDVLSLRH	DIALDDDART
MHV	KALSILQAKN	LCRDVKFETN	ACDSLFSS--	-DSCFVSSYD	VLQVEVLLRH	DIQLODDARV
AIPV	-----	-----	-----	-----	-----WLLA	NLAEHFDADY
SARS CoV	LNEPLVTMPI	GYVTHGFNLE	EAARCMR---	-SLKAPAVVS	VSSPDAVTTY	NGYLTSSSKT

	1685	1695	1705	1715	1725	1735
EMCR	SCTIYMCVVP	SI-NDLSFDC	NLGRVCVRKL	RLKTCVIANV	PAIDVLKLL	SSLTLTVKFV
229E	SVVVYMCVVP	SE-KDKHLDN	NVQRCTRKL	RLMCDIVCTI	PADYILPLVL	SSLTCNVSFV
PEDV	MISITMVVLP	FD-GDANYDK	NYARAVVKVS	KLKGLVLAV	DDATLYSKLS	-----HLSVLGFV
TGEV	-----CSIP	-----	-----	-----	-----	-----
OC43	FVQSNVDVVP	EG-WRVVNKF	YQINGVRTVK	YFECTGGIDI	CSQDKVFGYV	QQGIFNKATV
BoCoV	FVQSNVDVVP	EG-WRVVNKF	YQINGVRPVK	YFECPPGIDI	CSQDKVFGYV	QQGSFNKATV
MHV	FVQAHMDNLP	AD-WRLVNKF	DSVDGVRTVK	YFECPEIFV	SSQGGKFGYV	QNGSFKVASV
AIPV	TNAFLKKRVS	CN-----	-----	-----CG--	-----	-----
SARS CoV	SEEHFVETVS	LAGSYRDSWS	SGQRTELQVE	FLKRGDKIVY	HTLESPVEFH	LDG--EVLSL

	1745	1755	1765	1775	1785	1795
EMCR	VESNVMDVND	CFKNDNVVLK	ITEDGINVKD	VVVESSKSLG	KQLG-VVSDG	VDSFEGVLP-
229E	GELKAAEA--	----KVITIK	VTEDGVNVHD	VTVTDKSFE	QOQG-VIADK	BKDLGSAVPS
PEDV	STPDDVER--	FYANKSVVVK	VTEDTRSVKA	VKVESTATYG	QQIG-PCLVN	DTVVTDNKP-
TGEV	-----	-----VN	VTEDNVNHER	VSVSFDKTYG	EQLKGTVVVK	DKDVTNQLPS
OC43	AQIKALFLD-	-----KVDIL	LTVDGVNFTN	RFVPVGESFG	KSLG-NVFC	GVNVTKHKCD
BoCoV	AQIKALFLD-	-----KVDIL	LTVDGVNFTN	RFVPVGESFG	KSLG-NVFC	GVNVTKHKCD
MHV	SQIRALLAN-	-----KVDVL	CTVDGVNFRS	CCVAEGEVFG	KTLG-SVFC	GINVTKVRCS
AIPV	-----	-----IKSYE	LRGLEACIQP	VRATNLLHFK	TQYSNCPTCG	ANNTDEVIEA
SARS CoV	DKLSLSLSLR	--EVTKIKVF	TTVDNTNLHT	QLVDMSTYTG	QOFG-PTYLD	GADVTKIKPH

	1805	1815	1825	1835	1845	1855
EMCR	-INTDTVLSV	APEVDWVAFY	GFEKALFAS	LDVKPYG---	-----YPNDF	VGGFRVLGTT
229E	DLNTSELLTK	AIDVDWVEFY	GFKDAVTFAT	VDHSAFA---	-----YESAV	VNGIRVLKTS
PEDV	--VVDVVAKV	VPNANWDSHY	GFDKAGEFHM	LDHTGFT---	-----FPSEV	VNGRRVIKTT
TGEV	AFDVGQKVIK	AIDIDWQAHY	GFRDAAAFSA	SSHADYK---	-----FEVVT	HSNFIHVKQT
OC43	INYKGKVVFFQ	FDNLSSSEDLK	AVRSSFNFDO	KELLAYYNML	VNCFKWQVVV	NGKYFTFKQA
BoCoV	INYKGKVVFFQ	FDNLSSSEDLK	AVRSSFNFDO	KELLAYYNML	VNCFKWQVVV	NGKYFTFKQA
MHV	AIHKGKVVFFQ	YSGLSAADLV	AVTDAFGFDE	POLLKYNNML	G-MCKWPVVV	CGNYFAFKQS
AIPV	SLPYLLLFAT	DGPATVDCDE	DAVGTVVVFE	STNSGHY---	-----TQA	AGQAFDNLAK
SARS CoV	VNHEGKTFV	LPSDDTLRSE	AFEYHTLDE	SFLGRYMSAL	NHTKKWKFPQ	VGGLTSIKWA

	1865 1875 1885 1895 1905 1915
EMCR	DNNCWVNATC IILQYLKPTF KSKGLNLVLWN KFVTGADVGP VSFYFYFITMS SKGQKGDAAE
229E	DNNCWVNAV C IALQYSKPHF ISOGLDAAWN KFLVLDVEIF VAFVYYVARL MKGDKGDAED
PEDV	DNNCWVNVTC LQLQFARFRF KSAGLQAMWE SYCTGDVAMF VHWLYWLTGV DKGQPSDSEN
TGEV	DNNCWINAIC LALQRLKPQW KFPQVRGLWN EFLEKKTQGF VHMLYHISGV KKGEPGDAEL
OC43	NNNCFVNVSC LMLQSLHLTF KIVQWQEAWL EFRSGRPARF VALVLAKGGF KFGDPADSRD
BoCoV	NNNCFVNVSC LMLQSLNLKF KIVQWQEAWL EFRSGRPARF VSLVLAKGGF KFGDPADSRD
MHV	NNNCYINVAC LMLQHLSLKF HKWQWQEAWN EFRSGKPLRF VSLVLAKGSF KFNPSDSTD
AIPV	DRKFGKSPY ITAMYTRFAF KN-ETSLPVA KQSKGKSKSV KEDVSNLATS SKASFNDLTD
SARS CoV	DNNCYLSSVL LALQQLEVKF NAPALQEAYY RARAGDAANF CALILAYSNK TVGELGDVRE

	1925 1935 1945 1955 1965 1975
EMCR	ALSKLSEYLI S-----DSIVTLE QYSTCDIC--
229E	TLTKLSKYLA N-----EAQVLE HYSSCVECDA K-----
PEDV	ALNMLSKYIV P-----AGSVTIE RVTHDGCC--
TGEV	MLHKLGLDMD N-----DCEIIVT HTTACDKC--
OC43	FLRVVFSQVD LTGAICDF-E IACKCGVKQE QRTGLDAVMH FGTLSDRELE IGYTVDCSCG
BoCoV	FLRVVFSQVD LTGAICDF-E IACKCGVKQE QRTGVDVMH FGTLSDRELE IGYTVDCSCG
MHV	FMRVVLREAD LSGATCDF-E FVCKCGVKQE QRKGVDAVMH FGTLDKGDLA KGYTIACTCG
AIPV	FEQWYDSNIY ES-----LKVQE SPDNFDKY--
SARS CoV	TMTHLLQHAN LESAKRVLNV VCKHCGQKT TLTGVEAVMY MGTLSYDNLK TGVSI PCVCG

	1985 1995 2005 2015 2025 2035
EMCR	-----KSTVVEVKS VVCASVLKDG -----CDVGF CPHRH
229E	-----KNSVASINSA IVCASVKRDG -----VQVGYCVHGI
PEDV	-----CSKRVTAP VVNASVLKLG -----VEDGLCPHGL
TGEV	-----AKVEKFVGP VVAAPLAIHG -----TDE-TCVHGV
OC43	KKLIHCVRFD VP--FLICSN TPASVKLPKG VGSANIFIGD KVG-HYVHV KCEQSYQLYDA
BoCoV	KKLIHCVRFD VP--FLICSN TPASVKLPKG VGSANIFKGD KVG-HYVHV KCEQSYQLYDA
MHV	NKLHVHCTQLN VP--FLICSN KPEGKLPDD VVAANI FTGG SLG-HYTHVK CKPKYQLYDA
AIPV	-----VSFTTKEDS KLPLTLKVRG -----IK SVVDFRSKDG
SARS CoV	RDATQYLVQQ ESSFVMSAP PAEYKLOQGT FLCANEYTG YQCGHYTHIT AKETLYRIDG

	2045 2055 2065 2075 2085 2095
EMCR	KLRSRVKEFVN G-----RVVITNVGE
229E	KYYSRVRSVR G-----RAIIVSVEQ
PEDV	NYIGKVVVVK G-----TTIVNVGK
TGEV	SVNVKVTQIK G-----TVAITSILG
OC43	SNVKKVTDVT GKLSDCLYLK NLKQTFKSVL TTYLDDVK IEYKPDLSQY YCDGGKYYTQ
BoCoV	SNVKKVTDVT GNLSDCLYLK NLKQTFKSVL TTYLDDVK IEYKPDLSQY YCDGGKYYTQ
MHV	CNVSKVSEAK GNFTDCLYLK NLKQTFSSKL TTFYLDVK VEPNPDLSQY YCESGKYYTK
AIPV	FYIKLTPDTE EN-----S-----KAPVYYPVL
SARS CoV	AHLTKMSEYK GPVTDVFYKE TSYTTTIKPV SYKLDGVTYT EIEPKLDGY KKD NAYYTEQ

	2105 2115 2125 2135 2145 2155
EMCR	PIISQPSKLL NGIA--YTTF S-----GSFD NGHYYVVDAA NNAVYDGARL
229E	LEPCAQSRL SGVA--YTAF S-----GPVD KGHYTVYDTA KKSMDGDRF
PEDV	PVVAPSHLFL KGVS--YTTF LDN-----GNGV VGHYTVFDHG TGMVHDGDAF
TGEV	PIIG---EVL EATG--YICY S-----GSNR NGHYYTYDNR NGLVVD AEA
OC43	RIIKAQFKTF EKVDGVYTNF KLIGHTVCDS LNA-KLGFDS SKEFVEYKIT EWPTATGDVV
BoCoV	RIIKAQFKTF EKVDGVYTNF KLIGHTVCDI LNA-KLGFDS SKEFVEYKIT EWPTATGDVV
MHV	PIIKAQFRTF EKVEGVYTNF KLVGHSAEK FNA-KLGFDC NSPFTEYKIT EWPTATGDVV
AIPV	DAISLKAIWV EGNANFVVGH PN-----YYSKS LHPTFWENA ENFVKMGDKI
SARS CoV	PIDLVP TQPL PNAS--FDNF KLTCNTKFA DDLNQMTGFT KPASRELSVT FFPDLNGDVV

	2165 2175 2185 2195 2205 2215
EMCR	FASD-----LSTLAVTA IVVVGCVTS
229E	VKHD-----LSLLSVTS VVMVGCVTA
PEDV	VPGD-----LNVSPVTN VVVSEQTAVV
TGEV	YHFN-----RDLLQVTT AIASFVVKK
OC43	LATDDL YVKR YERGCITFGK PVIWLS----HEKASL NSLT YFNRP LVDNKF DVL
BoCoV	LATDDL YVKR YERGCITFGK PVIWLS----HEQASL NSLT YFNRP LVDNKF DVL
MHV	LASDDL YVSR YSGGCVTFGK PVIWLG----HEEASL KSLTYFNRP VVCENKF NVL
AIPV	GGVT-----MGLWRAEH LNKPNLERIF
SARS CoV	AIDYRHSAS FKKGAKLLHK PIVWHINQAT TKTTFKPNTW CLRCWSTKP VDTSNSFEVL

	2225 2235 2245 2255 2265 2275
EMCR	-----P--
229E	-----T
PEDV	-----P
TGEV	PQAEER-----
OC43	KVDDVD-----DGGDSSE SGAKE-----
BoCoV	KVDDVD-----DGGDISE SDAKE-----
MHV	PVDVSEPTDK GPVPAAVLVT GALSGAATAP GTAKEQKVCA SDSVVDQVVS GFLS DLSGAT
AIPV	N-----
SARS CoV	AVEDTQG-- MDNLACESQO PTSEEVVEN-

	2285	2295	2305	2315	2325	2335
EMCR	-----	-----	-----NVPP	IVSEKISVMD	KLDTG----	-----
229E	-----	-----	-----PV	NTVKPKPVIN	QLDEK----	-----
PEDV	-----	-----	-----IKDP	VKKAELDATK	LLDTMNY---	-----
TGEV	-----	-----KN	CAFNKVAASP	KIVQEQKLLA	IESGANY---	-----
OC43	KEINIIKLSG	VKKPKFKVEDS	VIVNDDTSET	KYVKLSLSIVD	VYDMWLTGCK	YVVRTANALS
BoCoV	KEINIIKLSG	VKKPKFKVEDS	VIVNDDTSEI	KYVKLSLSIVD	VYDMWLTGCR	CVVVRTANALS
MHV	VDVKEVKLNG	VKKPKFKVEDS	VVVNDPTSET	KYVKLSLSIVD	VYDMFLTGCR	YVVWMANELS
AIPV	-----	-----	-----IAKK	AIVGSSVTT	QCGLKIG---	-----
SARS CoV	PTIQKEVIEC	DVKTTEVVGN	VILKPSDEGV	KVTQELGHED	LMAAYVENTS	ITIKKPNELS
	2345	2355	2365	2375	2385	2395
EMCR	-----AQK	FFQFGDFVMN	N-----	-----	-----IV	LFLTWLLSMF
229E	-----AQK	FFDFGDFLIH	N-----	-----	-----FV	IFFTWLLSMF
PEDV	-----ASER	FFSFGDFMSR	N-----	-----	-----LI	TVFLYILSIL
TGEV	-----ALTE	FGRYADMFFM	A-----	-----	-----GD	KILRLLELVF
OC43	RAVNVPTIRK	FIKFGMTLVS	IPIDLLNLRE	IKPAVNVVKA	VRNKISVCFN	FIKWLFVLLF
BoCoV	RAVNVPTIRK	FIKFGMTLVS	IPIDLLNLRE	IKPVFNVVKA	VRNKISACFN	FIKWLFVLLF
MHV	RLVNSPTVRE	YVKWGMTKIV	IPAKLVLLRD	EKQEFVAPKV	VKAKVIACYS	AVKWFFLYCF
AIPV	-----K	AATFIADKVG	G-----	-----	-----G	VVRNITDSIK
SARS CoV	LALG---LKT	IATHGIAAIN	SVPWSKILAY	VKPFLLG---QA	AITTSNCAKR	LAQRVFNNYM
	2405	2415	2425	2435	2445	2455
EMCR	SLLRTSIMKH	DIKVIKAPK	RTGVILTRSF	KYNIRSALEFV	VKQKWC-VIV	TLFKFLLLLY
229E	TLCKTAVTTG	DVKIMAKAPQ	RTGVILKRS	KYNLKASAAV	LKSKWW-LLA	KFTKLLLLIY
PEDV	GLCFRAFRKR	DVKVLAVGPQ	RTGIILRKSM	RYNAKALGVF	FKLKLY-WFK	VLGKFSLSGIY
TGEV	KYLLVLFMCL	RSTKMPKVKV	KP-PLAFKDF	GAKVRTLNYM	RQLNKP-SVW	RYAKLVLLLI
OC43	GWIKISADNK	VIYTTETASK	LTCKLVALAF	KNAFLTFFKWS	MVARGA-CII	ATIFLLWFNF
BoCoV	GWIKISADNK	VIYTTETASK	LTCKLVALAF	KNAFLTFFKWS	VVARGA-CII	ATIFLLWFNF
MHV	SWIKENTDNK	VIYTTETASK	LTFFNLCLAF	KNALQTFNWN	VVSRRG-FLV	ATVFLWLFNF
AIPV	GLCGITRGHF	ERKMSPQFLK	TLMFLEFYFL	KASVKSVAAS	YKTVLCKVVL	ATLLIUVFVY
SARS CoV	PYVFTLLFQL	CTFTKSTNSR	IRASLPTTIA	KNSVKSVAKL	CLDAGI-NYV	KSPKFSKLFT
	2465	2475	2485	2495	2505	2515
EMCR	AIYALVFMIV	QFSPFNSL-L	CGDIVSGYEK	STF-----	-----NK	DIYCGNSMVC
229E	TLYSVLLCV	RFGPFN---F	CSETVNGYAK	SNF-----	-----VK	DDYCDGSLGC
PEDV	ALYALLFMTI	RFTPIGSP-V	CDDVVAGYAN	SSF-----	-----DK	NEYCN-SVIC
TGEV	AIYNFFYLFV	SIPVVHKL-T	CNGAQYAKN	SSF-----	-----IK	SAVCGNSILC
OC43	IYANVIFSDF	YLPKIGFLPT	FVGKIAQWIK	NTFSLVTICD	LYSMQDVGFK	NOYCNCSIAC
BoCoV	IYANVIFSDF	YLPKIGFLPT	FVGKIVQWIK	NTFSLVTICD	LYSIQDVGFK	NOYCNCSIAC
MHV	LYANVILSDF	YLPNIGFFPT	FVGQVAVVVK	TTFGIFTLCD	LYQVSDVGYR	SSFCNGSMVC
AIPV	TSNPVMTGI	RVLDLFLFEGS	LCGPYKDYGK	DSFD-----	-----VL	R-YCADDIFIC
SARS CoV	IAMWLLLLSI	CLGSLICVTA	AFGVLLSNFG	APSYCNGVRE	LYLNSNNVT	MDFCEGSFPC
	2525	2535	2545	2555	2565	2575
EMCR	KMCLFSYQEF	NLDLHTSLVW	KHIR----DP	ILISLQPFVI	LVILLIFG--	-----
229E	KMCLFGYQEL	SQFSLDQVW	KHIT----DP	LFSNMQPFIV	MVLLLLIFG--	-----
PEDV	KVCLYGYQEL	SDFSHTQVW	QHLR----DP	LIGNVMPFFY	LAFLAIFG--	-----
TGEV	KACLASYDEL	ADFQLQVTV	DFKS----DP	LWNRLVQLSY	FAFLAVFG--	-----
OC43	QFCLAGFDML	DNYKAIDVVQ	YEAD----RR	AFVDYTGVLK	IVIELIVSYA	LYTAWFYPLF
BoCoV	QFCLAGFDML	DNYKAIDVVQ	YEAD----RR	AFVDYTGVLK	IVIELIVSYA	LYTAWFYPLF
MHV	ELCFSGFDML	DNYDAINVQ	HVVD----RR	VSFYISLFLK	LVVELVIGYS	LYTVCFYPLF
AIPV	RVCLHDKDSL	HLKHYAYSVE	QVYKDAASGE	IFNWNWLYLV	FLILEVFKP--	-----
SARS CoV	SICLSGLDSL	DSYPALETIQ	VTISSYKLDL	TILGLAAEWV	LAYMLFTKFF	YLLG-----L
	2585	2595	2605	2615	2625	2635
EMCR	NMYLRFGLLY	FVAQFISTFG	SFLGFHQKQW	FLHFVPFDVL	CNEFLATFIV	CKIVLFVRHI
229E	DNYLRCFLLY	FVAQMISTVG	VFLGYKETNW	FLHFIPFDVI	CDELLVTIV	IKVISEVRHV
PEDV	GVYVKAITLY	FIFQYLNLSG	VFLGLQQSIW	FLQLVPFDVF	GDEIVVFVIV	TRVLMFIKHV
TGEV	NNYVRCFLMY	FVSQYLNLSL	SYFGYVEYSW	FLHVNVFESI	SAEFVIVVIV	VKAVLALKHI
OC43	ALISIQILT	WLPELFMLST	LHWSFRLVLA	LANMLPAHVF	MRFYIIIASF	IKLFSLFRHV
BoCoV	ALISIQILT	WLPELFMLST	LHWSVRLVLS	LANMLPAHVF	MRFYIIIASF	IKLFSLFRHV
MHV	GLIGMQLLTT	WLPEFMLET	MHWSARFFVF	VANMLPAFTL	LRFYIVVTAM	YKIFCLCRHV
AIPV	VAGFVIICVC	VKYLVLNSTV	LQTGVCFLDW	FVQTVFESHF	FMGAGFYFWL	FYKIYIQVHH
SARS CoV	SAIMQVFFGY	FASHFISNS-	---WLMWFIIS	IVQMAPVSAM	VRMYIFFASF	YYIWSYVHI
	2645	2655	2665	2675	2685	2695
EMCR	IVGCNNADCV	ACSKSARLKR	VPLQTIINGM	HKSFYVNANG	GTCFCNKHNF	FCVNCDSFGP
229E	LFGCENPDIC	ACSKSARLKR	FVPNTIVNGV	QRSFYVNANG	GSKFCKKHNF	FCVDCDSYGY
PEDV	CLGCDKASCV	ACSKSARLKR	VPVQTIQGT	SKSFYVHANG	GSKFCKKHNF	FCLNCDSYGP
TGEV	VFACSNPSCK	TCSRTARQTR	IPIQVVVNGS	MKTIVYVHANG	TGKFCCKHNF	YCNCDYSYGF
OC43	AYGCSKSGCL	FCYKRNRSLR	VKCSTIVGGM	IRYDYVMANG	GTGFCSKHQW	NCIDCDSYKP
BoCoV	AYGCSKSGCL	FCYKRNRSLR	VKCSTIVGGM	IRYDYVMANG	GTGFCSKHQW	NCIDCDSYKP
MHV	MYGCSRPGCL	FCYKRNRSLR	VKCSTIVGGM	IRYDYVMANG	GTGFCAKHQW	NCLNCDSYGP
AIPV	ILYCKDVTCE	VCKRVARSNR	QEVSVVVGGR	KQIVHVTNS	GYNFCKRHHN	YCRNCDYGH
SARS CoV	MDGCTSTCTM	MCYKRNRATR	VECTTIVNGM	KRSFYVYANG	GRGFCCKTHN	NCLNCDTFCT

	2705	2715	2725	2735	2745	2755
EMCR	GNTFINGDIA	RELGNVVKTA	VQPTAPAYVI	IDKVDFVNGF	YRLYSGDTFW	RYDFDITESK
229E	GSTFITPEVS	RELGNITKTN	VQPTGPAYVM	IDKVEFENG	YRLYSCETFW	RYNFDITESK
PEDV	GCTFINDVIA	TEVGNNVVKLN	VQPTGPATIL	IDKVEFSNGF	YYLYSGDTFW	KYNFDITDSK
TGEV	ENTFICDEIV	RDLSNSVKQT	VYATDRSHQE	VTKVECSDFG	YRFYVGDEF	SYDYDVKKHK
OC43	GNTFITVEAA	LDLSKELKRP	IQPTDVAYHT	VTQVQVGC	MRLFYDRDGO	RTYDDVNASL
BoCoV	GNTFITVEAA	LDLSKELKRP	IQPTDVAYHT	VTQVQVGCY	MRLFYDRDGO	RTYDDVNASL
MHV	GNTFITHEAA	ADLSKELKRP	VNPTDSAYYL	VTEVKQVGC	MRLFYERDGO	RVYDDVSASL
AIPV	QNTFMSPEVA	GELSEKLRH	VKPTAYAYHV	VDEACLVDGF	VNLKYKAATP	GKDSASSAVK
SARS CoV	GSTFISDEVA	RDLQLQKRP	INPTDQSSYI	VDSVAVKNGA	LHLYFDKAGQ	KTYERHPLSH

	2765	2775	2785	2795	2805	2815
EMCR	YSCKEVLKN-	-----	CNVLENFIVY	NNSGS--NIT	QIKNACVYFS	QLLCEPIKLV
229E	YSCKEVLKN-	-----	CNVLDFFIVY	NNNGT--NVT	QVKNASVYFS	QLLCRPKLV
PEDV	YTCKEALKN-	-----	CSIITDFIVY	NNNGS--NVN	QVKNACVYFS	QMLCKPVKLV
TGEV	YSSQEVLS-	-----	MLLLDDFIVY	SPSGS--ALA	NVRNACVYFS	QLIGKPIKIV
OC43	FVDYSNLLHS	-----KV	KSVPMNHVVV	VENDA--DKA	NFLNAAVFYA	QSLFRPILMV
BoCoV	FVDYSNLLHS	-----KV	KSVPMNHVVV	VENDA--DKA	NFLNAAVFYA	QSLFRPILMV
MHV	FVDMNGLLHS	-----KV	KGVPETHVVV	VENEA--DKA	GFLNAAVFYA	QSLYRPMILV
AIPV	CFSVTDFLKK	AVFLKEALKC	EQISNDGFIV	CNTQSAHALE	EAKNAAYYA	QYLCKPILIL
SARS CoV	FVNLNLRAN	-----NT	KGSLPINVIV	FDGKSKCDES	ASKSASVYYS	QLMCQPILLL

	2825	2835	2845	2855	2865	2875
EMCR	NSELLSTLS-	-VDFNGVLHK	AYVDVLCNSF	FKELTANMSM	AECKATLGLT	-----
229E	DSELLSTLS-	-VDFNGVLHK	AYIDVLRNSF	GKDLNANMSL	AECKRALGLS	-----
PEDV	DSALLASLS-	-VDFGASLHS	AFVSVLSNSF	GKDLSSCNDM	QDCKSTLGFD	D-----
TGEV	NSDLLELDS-	-VDFKGALFN	AKKNVIXNSF	NVDVSECKNL	DECYRACNLN	-----
OC43	DKNLITTANT	GTSVTETMFD	VYVDTFLSMF	DVDKKSLLNAL	IATAHSSIKQ	GTQIYKVLDT
BoCoV	DKILITTANT	GTSVTETMFD	VYVDTFLSMF	DVDKKSLLNAL	IATAHSSIKQ	GTQICKVLDT
MHV	EKKLITTANT	GLSVSQTMTD	LYVDSLLGVL	DVDRKSLTSF	VNAAHNSLKE	GVQLEQVMDT
AIPV	DQALYEQLVV	-EPVSKSVID	KVCSILSSII	SVDTAALNYK	AGTLRDALLS	-----
SARS CoV	DQVLVSDVGD	STEVSVKMTD	AYVDTFSATF	SVPMEKLLAL	VATAHSELAK	GVALDGVVLT

	2885	2895	2905	2915	2925	2935
EMCR	-----	-----VSDDDF	VSAVANAHRY	DVLLSDLSFN	NFFISYAKPE	DK-LSVYDIA
229E	-----	-----ISDHEF	TSAINAHRC	DVLLSDLSFN	NFVSSYAKPE	EK-LSAYDIA
PEDV	-----	-----VPLDTF	NAAVAEAHRY	DVLLTDMFSN	NFTTSYAKPE	EK-FPVHIDIA
TGEV	-----	-----VSFSTF	EMAVNNAHRF	GILITDRSFN	NEWPSKVKPG	SSGVSAMDIG
OC43	FLSCARKSCS	IDSVDVTKCL	ADSVMSAVSA	GLELTDESCN	NLVPTYLKSD	N--IVAADLG
BoCoV	FLSCARKSCS	IDSVDVTKCL	ADSVMSAVSA	GLELTDESCN	NLVPTYLKGD	N--IVAADLG
MHV	FTGCARRKCA	IDSVDVETKSI	TKSIMSAVNA	GVDFTDDESCN	NLVPTYVKSD	T--IVAADLG
AIPV	-----	-----ITKDEEA	VDMIAFCHNH	DVDYTGDFGT	NVIPSYGIDT	G-KLTPRDLG
SARS CoV	FVSAARQG-V	VDTVDVTKDV	IECLKLSHHS	DLEVTGDSCN	NFMLTYNKVE	N--MTPRDLG

	2945	2955	2965	2975	2985	2995
EMCR	CCMRAGSKVV	NHNVLKIESI	PIVWGVKDFN	TLSEQGKKYL	VKTTKAKGLT	FLITFNDNQA
229E	CCMRAGAKVV	NANVLTKDQT	PIVWHAKDFN	SLSAEGRKYI	VKTSKAKGLT	FLLTINENQA
PEDV	TCMRVGAIV	NHNVLVKDSI	PVVWLVRDFI	ALSEETRKYI	IRTTKVKGIT	FMLTFNDCRM
TGEV	KCMSTDAKIV	NAKVLTKQK	SVVWLSQDFA	ALSSTAQKVL	VKTVEEGVN	FSLTFNAGVS
OC43	VLIQNSAKHV	QGNVAKIAGV	SCIWSVDAFN	QFSSDFQHLK	KKACCKTGLK	LKLTYNKQMA
BoCoV	VLIQNSAKHV	QGNVAKIAGV	SCIWSVDAFN	QLSSDFQHLK	KKACCKTGLK	LELTYNKQMA
MHV	VLIQNNAKHV	QANVAKAANV	ACIWSVDAFN	QLSADLQHRL	RRACSKTGLK	IKLTYNKQEA
AIPV	FLINADASIA	NLRVKN--AP	PVVWKFSELI	KLSDSCLKYL	ISATVKSGVR	FFITKSGAKV
SARS CoV	ACIDCNARHI	NAQVAKSHNV	SLIWNVKDYM	SLSEQLRKQI	RSAAKKNNIP	FRLTCATTRQ

	3005	3015	3025	3035	3045	3055
EMCR	ITQVP----A	TSIVAKQGAG	-----	FKRTYNFLWY	VCLFVVALFI	GVSFID----
229E	VTQIP----A	TSIVAKQGAG	D-----	AGHSLTWLWL	LCGLVCLIQF	YLCFFMPY--
PEDV	HTTIP----T	VCIAKKGAG	LP-----S	FSKVKKFFWF	LCLFIVAFAF	ALSFLD----
TGEV	DDDLPYERFT	ESVSPKSGSG	-----	FFDVITQLKQ	IVILVFVFIF	ICGLCSVYSV
OC43	NVSVL----T	TPFSLKGGAV	FS-----Y	FVYVCFVLSL	VCFIGLWCLM	PTYTVH----
BoCoV	NVSVL----T	TPFSLKGGAV	FS-----Y	FVYVCFVLSL	VCFIGLWCLM	PTYTVH----
MHV	NVPIL----T	TPFSLKGGAV	FS-----K	VLOWLFVNL	ICFIVLWALM	PTYAVH----
AIPV	VIACT--QK	LLVEKKAGGI	VSGTFKCFKS	YFKWLLIFYI	LFTACCSGYY	YMEVSKSFVH
SARS CoV	VVNVI----T	TKISLKGKGI	VS-----T	CFKLMLKATL	LCVLAALVCY	IVMPVHTLS-

	3065	3075	3085	3095	3105	3115
EMCR	-YTTTTSFHF	GYDFKYIENG	QLKVFEAPLH	CVRNVDFNFN	QWHEAKFGVV	TNNSD-KCPI
229E	FMYDIVSSFE	GYDFKYIENG	QLKNFEAPLK	CVRNVDFNFE	DWHYAKFGFT	PLNKQ-SCPI
PEDV	-FSTQVSSDS	DYDFKYIESG	QLKTFDNPLS	CVHNVFINFD	QWHDAGFGFT	PVNNP-SCPI
TGEV	ATQSYIESAE	GYDYMVIKNG	IVQPFDDTIS	CVHNTYKGF	DWFKAKYGF	PTFGK-SCPI
OC43	--KSDFLQPV	YASYKVLNNG	VIRDVSVEDV	CFANKFEQFD	QWYESTFGLS	YYSNSMACPI
BoCoV	--KSDFLQPV	YASYKVLNNG	VIRDVSVEDV	CFANKFEQFD	QWYESTFGLS	YYSNSMACPI
MHV	--KSDMLQPL	YASFKVIDNG	VLRDVTVDTA	CFANKFIQFD	QWYESTFGLV	YYSNSRACPV
AIPV	PMYDVNSTLH	VEGFKVIDKG	VLRDVTVDTA	CFANKFIQFD	QWYESTFGLV	YYSNSRACPV
SARS CoV	--IHDGYTNE	IIGYKAIQDG	VTRDIISTDD	CFANKHAGFD	AWFSQRGGSY	KNDKS--CPV

	3125	3135	3145	3155	3165	3175
EMCR	VVG---VUSER	INVVPGVPTN	VYLVG----	-----KTLV	FTLQAAFGNT	GVCYDFDGV
229E	VVG---VSEI	VNTVAGIPSN	VYLVG----	-----KTLI	FTLQAAFGNA	GVCYDIFGV
PEDV	VVG---VSDE	ARTVPGIPAG	VYLAG----	-----KTLV	FAINTIFGTS	GLCFDASGVA
TGEV	VVGTVFDLEN	MRPIPDVPAY	VSIVG----	-----RSLV	FAINAAFGVT	NMCYDHTGNA
OC43	VVA-VIDQDF	GSTVENVPVK	VLRYG----	-----YHVL	HFITHALSAD	GVQCYTPHSQ
BoCoV	VVA-VVDQDF	GSTVENVPVK	VLRYG----	-----YHVL	HFITHALSAD	GVQCYTPHSQ
MHV	VVA-VIDQDI	GYTLENVPVK	VLRYG----	-----FHVL	HFITHAFATD	SVQCYTPHMQ
AIPV	VTA--VIDGD	GTVATGVPGF	VSWMDGVMF	IHMTQTERKP	WYIPTWFNRE	IVGYTQDSII
SARS CoV	VAA-IITREI	GFIVPGLPGT	VLRAIN----	-----GDFL	HFLPRVFSAV	GNICYTPSKL

	3185	3195	3205	3215	3225	3235
EMCR	TS-----DK	CIFNSACTRL	EGLGGD-NVY	CYN-TDLIEG	SKPYSILQPN	AYYKYDVKN-
229E	TP-----EK	CIFTSACTRL	EGLGGN-NVY	CYN-TALMEG	SLPYSSIQAN	AYYKYDNGN-
PEDV	DK-----GA	CIFNSACTTL	SGLGGT-AVY	CYK-NGLVEG	AKLYSELAPH	SYXKMDGN-
TGEV	VSKD-SYFDT	CVFNTACTTL	TGLGGT-IVY	CAK-QGLVEG	AKLYSDLMPD	YYEHASGN-
OC43	ISYSNFIYASG	CVLSSACTMF	TMDGSPQPY	CYT-EGLMQN	ASLYSSLVPH	VRYNLANAKG
BoCoV	ISYSNFIYASG	CVLSSACTMF	AMADGSPQPY	CYT-DGLMQN	ASLYSSLVPH	VRYNLANAKG
MHV	IPYDNFIYASG	CVLSSSLCTML	AHADGTPHPY	CYT-EGIMHN	ASLYDSLAPH	VRYNLANANS
AIPV	TEG-SFYTSI	ALFSARCLYL	TASNTP-QLY	CFNGDNDAPG	ALPFGSIIIP	RVYFQPNVGR
SARS CoV	IEYSDFATSA	CVLAAECTIF	KDAMGKPVY	CYD-TNLLEG	SISYSELRPD	TRYVLMDS-

	3245	3255	3265	3275	3285	3295
EMCR	YVRFPEILAR	GFGLRTIRTL	ATRYCRVGEC	RDSHKGVCFC	FDKWYVNDGR	VD---DGYIC
229E	FIKLEPIVIAQ	GFGRFTRVTI	ATKYCRVGEC	VESNAGVCFC	FDKWVNDGR	VA---NGYVC
PEDV	AVSLPEIISR	GFGRITIRTK	AMTYCRVGQC	VQSAEGVCFC	ADRFVYNAE	SG---SDFVC
TGEV	MVKLPAIIR-	GLGLRFVKTK	ATTYCRVGEC	IDSKAGFCFC	GDNWFVYDNE	FG---NGYIC
OC43	FIRLEPEVLRE	GL-VRIVRTR	SMSYCRVGLC	EEADEGICFN	FNGSWVLNND	YYRSLPGTFC
BoCoV	FIRLEPEVLRE	GL-VRIVRTR	SMSYCRVGLC	EEADEGICFN	FNGSWVLNND	YYRSLPGTFC
MHV	YIRFPEVVSE	GI-VRIVRTR	SMTYCRVGLC	EDAEEGVCFC	FNSSWVLNND	YYRAMPGTFC
AIPV	LIVPQILHT	PY---VVKFV	SMSYCRGSVC	EYTRPGYCVS	LNPQWVLFND	EYTSKPGVFC
SARS CoV	IIQFPNTYLE	GS-VRVVTTT	DAEYCRHGTC	ERSEVGICLS	TSGRWVLNNE	HYRALSGVFC

	3305	3315	3325	3335	3345	3355
EMCR	GDGLIDLIVN	VLSIFSSSFS	VVAMSGHMLF	NFLFAAFITF	LCFLVTKFKR	VFGDLSYGVF
229E	GTGLWNLVFN	ILSMFSSSFS	VAAMSGQILL	NCALGAFATF	CCFLVTKFKR	MFGDLSVGVF
PEDV	GTGLFTLLMN	VISVFSKTVF	VTVLGQILF	NCIIAFVAVA	VCFLFTKFKR	MFGDMSVGVF
TGEV	GNSVLGFFKN	VFKLFNSNMS	VVATSGAMLV	NIIIACLAIA	MCYGVLFKFK	IFGDCTFLIV
OC43	GRDVFDLIYQ	LFKGLAQPDV	FLALTASSIA	GAILAVIVVL	VFYLYLKLKR	AFGDYTSVVF
BoCoV	GRDVFDLIYQ	LFKGLAQPDV	FLALTASSIA	GAILAVIVVL	GFYLYLKLKR	AFGDYTSIVF
MHV	GRNAFDLIHQ	VLGGLVRPID	FFALTASSVA	GAILAVIVVL	AFYLYLKLKR	AFGDYTSVVF
AIPV	GSTVRELMSF	VMSTFTTGVN	-PNIYKQLAT	MFLILVVVVL	IFAMVIKQFQ	YFKAYATTVF
SARS CoV	GVDAMNLIAN	IFTPLVQPVG	ALDVSASVVA	GGIIAILVTC	AAYYFMKFR	VFGYNNHVVA

	3365	3375	3385	3395	3405	3415
EMCR	TVVVCATLINN	ISYVVTQN-L	FFMLLYAILY	FVFTRTVR--	YAWIWHIAYI	VAYFLLIPWW
229E	TVVVAVLLNN	VSIIYVTQN-L	VTMIAYAILY	FFATRSRLR--	YAWIWCAYYL	IAYISFAPWW
PEDV	TVGACTLLNN	VSIIYVTQN-T	LGMLGYATLY	FLCTKGVR--	YMWIWHLGFL	ISYILAPWW
TGEV	MIIIVTLVVNN	VSIIYVTQN-T	FFMIIYAIVY	YFITRKLA--	YPGILDAGFI	IAYINMAPWY
OC43	VNVIWVCVNF	MMLEFVQVYP	ILSCVYAICY	FYATLYFPSE	ISVIMHLQWL	VMYGTIMPLW
BoCoV	VNVIWVCVNF	MMLEFVQVYP	TLSCVYAICY	FYATLYFPSE	ISVIMHLQWL	VMYGTIMPLW
MHV	INVIWVCINF	LMLFVQVYP	TLSCLYACFY	FYTTLYFPSE	ISVVMHLQWL	VMYGAIMPLW
AIPV	ITMLVWVINA	FILCVHSYNS	VLAVILLVLY	CYASLVTSRN	TVIIMHCLWL	FTFGLIVPTW
SARS CoV	ANALLFLMSF	TILCLVPAYS	FLPGVYSVVF	LYLTFYFTND	VSFLAHLQWF	AMFSPIVPFW

	3425	3435	3445	3455	3465	3475
EMCR	LLTWFSFAAF	LELLPNVFKL	K----ISTQL	FEGDKFIGTF	ESAAAGTFVL	DMRSYERLIN
229E	LCAWYFLAML	TGLLPSLLKL	K----VSTNL	FEGDKFVGTF	ESAAAGTFVI	DMRSYEKLAN
PEDV	VLMVYAFSAI	FEFMPNLFKL	K----VSTQL	FEGDKFVGSE	ENAAAGTFVL	DMHAYERLAN
TGEV	VITAYILVFL	YDSLPSLFKL	K----VSTNL	FEGDKFVGNF	ESAAMGTTFVI	DMRSYETIVN
OC43	FCLLYIAVVV	SN--HAFWVF	S----YCRKL	GTSVRSDDGT	EEMALTTFMI	TKDSYCKLKN
BoCoV	FCLLYISVVV	SN--HAFWVF	S----YCRQL	GTSVRSDDGT	EEMALTTFMI	TKDSYCKLKN
MHV	FCIIYVAVVV	SN--HALWLF	S----YCRKL	GTEVRSDDGT	EEMSLTTFMI	TKESYCKLKN
AIPV	LACCYLGFI	YMYTFLFLWC	YGTTRKTRKL	YDGNFVGNV	DLAAKSTFVI	RGSEFVKLTN
SARS CoV	ITAIYVFCIS	LKHCHWFFNN	Y----LRKRV	MFNGVTFSTF	EAAALCTFLL	NKEMYLKLRS

	3485	3495	3505	3515	3525	3535
EMCR	T--ISPEKLL	NYAASYNKYK	YYSGSASEAD	YRCACYAHLA	KAMLDYAKDH	N-DMLYSPPT
229E	S--ISPEKLL	SYAASYNRYK	YYSGNANEAD	YRCACYAYLA	KAMLDFSRDH	N-DILYTPPT
PEDV	S--ISTEKLL	QYASTYNKYK	YYSGSASEAD	YRLACFAHLA	KAMMDYASNH	N-DTLYTPPT
TGEV	S--TSIARIK	SYANSFNKYK	YYSGSMGEAD	YRMACYAHLG	KALMDYSVNR	T-DMLYTPPT
OC43	S--LSDVAFN	RYLSLYNKYR	YYSCKMDTAA	YREAACSQLA	KAMDTFTNNN	GSDVLYQPPT
BoCoV	S--LSDVAFN	RYLSLYNKYR	YYSCKMDTAA	YREAACSQLA	KAMDTFTNNN	GSDVLYQPPT
MHV	S--VSDVAFN	RYLSLYNKYR	YFSCKMDTAA	YREAACSQLA	KAMDTFTNNN	GSDVLYQPPT
AIPV	E--I-GDKFE	AYLSAYARLK	YYSCTGSEQD	YLQACRAWLA	YALDQYR-NS	GVEIVYTPPR
SARS CoV	ETLLPLTQYN	RYLALYNKYK	YFSGALDTTS	YREAACCHLA	KALNDFS-NS	GADVLYQPPT

	3545	3555	3565	3575	3585	3595
EMCR	ISYN-STLQS	GLKKMAQPSG	CVERCVVRVC	YGSTVLNGVW	LGDTVTCPRH	VIAPS-TTVL
229E	VSYG-STLQA	GLRKMAQPSG	FVEKCVVRVC	YGNTVLNGLW	LGDIVYCPRH	VIASN-TTSA
PEDV	VSYN-STLQA	GLRKMAQPSG	VVEKCIVRVC	YGNMALNGLW	LGDIVMCPRH	VIASS-TTST
TGEV	VSVN-STLQS	GLRKMAQPSG	LVEPCIVRVS	YGNMVLNGLW	LGDEVICPRH	VIASD-TTRV
OC43	ASVSTSFLOS	GIVKMNPTS	KVEPCVVSVT	YGNMTLNGLW	LDDKVYCPRH	VICSASDMTN
BoCoV	ASVSTSFLOS	GIVKMNPTS	KVEPCIVSVT	YGNMTLNGLW	LDDKVYCPRH	VICSASDMTN
MHV	ASVTTSFLOS	GIVKMFPTS	KVEPCVVSVT	YGNMTLNGLW	LDDKVYCPRH	VICSSADMTD
AIPV	YSIGVSRLOS	GFKKLVSPTS	AVEKCIVSVS	YRGNNLNGLW	LGDTIYCPRH	VLG---KFSG
SARS CoV	TSITS AVLQS	GFRKMAFPSS	KVEGCMVQVT	CGTTTLNGLW	LDDTVYCPRH	VICTAEDMLN

	3605	3615	3625	3635	3645	3655
EMCR	IDYDHAYSTM	RLHNFSVSHN	G-VFLGVVGV	TMHGSVLRK	VSQSNVHTPK	HVFKTLLKPGA
229E	IDYDHEYSIM	RLHNFSIISG	T-AFLGVVGA	TMHGVTLKIK	VSQTNMHTPR	HSFRTLKSGE
PEDV	IDYDYALSVL	RLHNFSISSG	N-VFLGVVSA	TMRGALLQIK	VNQNNVHTPK	YTYRTVRPGE
TGEV	INYENEMSSV	RLHNFSVSKN	N-VFLGVVSA	RYKGVNLVLK	VNQVNPTPE	HKFKSIKAGE
OC43	PDTNLLCRV	TSSDFTVLFD	R-LSLTVMSY	QMRGCMVLVT	VTLQNSRTPK	YTFGVVKPGE
BoCoV	PDTNLLCRV	TSSDFTVLFD	R-LSLTVMSY	QMRGCMVLVT	VTLQNSRTPK	YTFGVVKPGE
MHV	PDYSNLLCRV	ISSDFCVMSS	R-MSLTVMSY	QMQGSLVLVT	VTLQNPPTPK	YSFGVVKPGE
AIPV	DQWNDVLNLA	NNHEFEVTTQ	HGVTLLNVVS	RLKGAVLILQ	TAVANAETPK	YKFIKANCOD
SARS CoV	PNYEDLLIRK	SNHSFLVQAG	N-VQLRVIGH	SMQNCLLRLK	VDTSNPKTPK	YKFVRIQPGQ

	3665	3675	3685	3695	3705	3715
EMCR	SFNILACYEG	IASGVFVGNL	RTNFTIKGSF	INGACGSPGY	NVRNDGTVEF	CYLHQIELGS
229E	GFNILACYDG	CAQGVFVGNM	RTNFTIRGSF	INGACGSPGY	NLKN-GEVEF	YVMHQIELGS
PEDV	SFNILACYDG	AAAGVYGVNM	RSNYTIRGSF	INGACGSPGY	NINN-GTVEF	CYLHQIELGS
TGEV	SFNILACYEG	CPGSVYGVNM	RSQGTIKGSF	IAGTCGSVGY	VLEN-GILYF	YVMHHELEGN
OC43	TFTVLAAYNG	KPQGAHVMTM	RSSYTIKGSF	LCGSCGSVGY	VIMG-DCVKF	VYMHQLELST
BoCoV	TFTVLAAYNG	KPQGAHVMTM	RSSYTIKGSF	LCGSCGSVGY	VIMG-DCVKF	VYMHQLELST
MHV	TFTVLAAYNG	KSQGAHVMTM	RSSYTIKGSF	LCGSCGSVGY	VLTG-DSVRF	VYMHQLELST
AIPV	SFTIACAYGG	TVVGLYPVTM	RSNGTIRASF	LAGACGSVGF	NIEK-GVVNF	FYMHHELEPN
SARS CoV	TFSVLACYNG	SPSGVYQCAM	RPNHTIKGSF	LNGSCGSVGF	NIDY-DCVSF	CYMHHELEPT

	3725	3735	3745	3755	3765	3775
EMCR	GAHVGSDFTG	SVYGNFDDQP	SLQVESANLM	LSDNVVAFLY	AALLNGCR--	----WWLRST
229E	GSHVGSDFDG	VMYGGFEDQP	NLQVESANQM	LTNVVAVFLY	AAILNGCT--	----WWLKGE
PEDV	GCHVGSDDLQ	VMYGGYEDQP	TLQVEGASSL	FTENVLAFLY	AALINGST--	----WWLSSS
TGEV	GSHVGSNFEF	EMYGGYEDQP	SMQLEGTNVM	SSDNVAVFLY	AALINGER--	----WFVTSD
OC43	GCHTGTDFNG	DFYGPYKDAQ	VVQLLQDYI	QSVNFAVWLY	AAILNLCN--	----WFVQSD
BoCoV	GCHTGTDFNG	DFYGPYKDAQ	VVQLPVQDYI	QSVNFAVWLY	AAILNLCN--	----WFVQSD
MHV	GCHTGTDFSG	NFYGPYRDAQ	VVQLPVQDYI	QTVNVAVWLY	AAILNRCN--	----WFVQSD
AIPV	ALHTGTDLMG	EFYGGYVDEE	VQRPVPPDNL	VTNNIVAWLY	AAIISVKESF	FSLPKWLEST
SARS CoV	GVHAGTDLEG	KFYGPFVDRQ	TAQAAGTDTT	ITLNLVLAFLY	AAVINGDR--	----WFLNRF

	3785	3795	3805	3815	3825	3835
EMCR	RVNVDFGNEW	AMANGYTIVS	SV--ECYSIL	AAKTGVSVEQ	LLASIQHLHE	-GFGGKNILG
229E	KLFVEHYNEW	AQANGFTAMN	GE--DAFSIL	AAKTGVCEVER	LLHAIQVLNN	-GFGGKQILG
PEDV	RIAVDRFNEW	AVHNGMTTVG	NT--DCFSIL	AAKTGVDVQR	LLASIQSLHK	-NFGGKQILG
TGEV	SMSLESYNTW	AKTNSFTELS	ST--DAFSML	AAKTGQSVEK	LLDSIVRLNK	-GFGGRITLS
OC43	KCSVEDFNWV	ALSNGFSQVK	SD--LVIDAL	ASMTGVSLET	LLAAIKRLKN	-GFGGRQIMG
BoCoV	KCSVEDFNWV	ALSNGFSQVK	SD--LVIDAL	ASMTGVSLET	LLAAIKRLKN	-GFGGRQIMG
MHV	SCSLEEFNVW	AMTNGFSSIK	AD--LVLDAL	ASMTGVTVEQ	LLAAIKRLYS	-GFGGKQILG
AIPV	TVSVDDYNKW	AGDNGFTPFS	TS--TAITKL	SAITGVDVCK	LLRTIMVKNS	-QWGGDIILG
SARS CoV	TTTLNDFNLV	AMKYNYEPLT	QDHVDILGPL	SAQTGIAVLQ	MCAALKELLQ	NGMNGRTILG

	3845	3855	3865	3875	3885	3895
EMCR	YSSLCDEFTL	AEVVQKMYGV	NLQSGK---V	IFGLKTMFLF	SVFFTMFWAE	LFIYNTTIWI
229E	YSSLNDEFSI	NEVVQKMFVG	NLQSGK---T	TSMFKSISLF	AGFFVMFWAE	LFVYTTTIWV
PEDV	HTSLTDEFTT	GEVVQKMYGV	NLQGGY---V	SRACRNVLLV	GSFLTFFWSE	LVSYTKFFWV
TGEV	YSSLCDEFTP	TEVIRQMYGV	NLQAGK---V	KSFFYPIMTA	MTILFAFWLE	FFMYTPTFTWI
OC43	SCSFEDELTP	SDVYQQLAGI	KLQSKRTRLF	KGTVCWIMAS	TFLFSCIITA	FVKWTFMFMV
BoCoV	SCSFEDELTP	SDVYQQLAGI	KLQSKRTRLV	KGTVCWIMAS	TFLFSCIITA	FVKWTFMFMV
MHV	SCVLEDELTP	SDVYQQLAGV	KLQSKRTRVV	KGTCCWILAS	TLLFSCIISA	FVKWTFMFMV
AIPV	QYNFEDELTP	ESVFNQIGGV	RLQSSFVR--	K--ATSWFWS	RCVLACFLFV	LCAIVLFTAV
SARS CoV	STILEDELTP	FDVVVRQCSGV	TFQKGFKKIV	KGTHHWMLLT	FLTSLILVQ	STQWSLFFV

	3905	3915	3925	3935	3945	3955
EMCR	NPVILTPIFC	LLLFLSLVLT	MFLKHKRFLF	QVFLLPVIA	TALYNC-VLD	YYIVKFLADH
229E	NPVFLTPFMI	LLVALSLCLT	FVVKHKVLF	QVFLLPVIA	AAIQC-AWD	YHVTKVLAEK
PEDV	NPVYVTPMFA	CLSLSSLLM	FTLKHKTLLF	QVFLIPALIV	TSCINL-AFD	VEVYNYLAEH
TGEV	NPTFVSIVLA	VTTLISTVFV	SGIKHKMLFF	MSFVLPSVIL	VTANHL-FWD	FSYYESLQSI
OC43	TTNMSITFC	ALCVIS-LAM	LLVKKHKLHL	TMYITP-VLF	TLLYNN-YLV	YKHTFRGYV
BoCoV	TTNMSITFC	ALCVIS-LAM	LLVKKHKLHL	TMYIIP-VLF	TLLYNN-YLV	YKHTFRGYV
MHV	TLHMLGVTL	ALCFVS-FAM	LLVKKHKLHL	TMFIMP-VLC	TIFYTN-YLV	YVQKSRFLA
AIPV	PLKFVYAAV	ILLMAVLFIS	FTVKKHKLHL	DTFLPLTIT	VIIGVCAEVP	FIYNTLISQV
SARS CoV	YENAFLPFTL	GIMAIACAM	LLVKKHKLHL	CLFLLPLAT	VAYFN---MV	YMPASVWMRI

	3965 3975 3985 3995 4005 4015
EMCR	FN-YNVSVLQ MDVQGLVNVL VCLFVVFHL- --TWRFSKER FTHWFTYVCS LIAVAYTYFY
229E	FD-YNVSMQ MDIQGFVNIF ICLFVALLH- --TWRFAKER CTHWCTYLES LIAVLYTALY
PEDV	FD-YHVSIMG FNAQGLVNIF VCFVVTILHG TYTWRFFN-T PASSVTYVVA LLTAAYNYFY
TGEV	VENTNTMFLP VDMQGVMLTV FCFIVFVTYS VREFTCKQSW FSLAVTTILV IFNMVKIFGT
OC43	YAWLSYYVPS VEYTYTDEVI YGMLLLVGMV FVTLRSINHD LFSFIMFVGR LISVFSLWYK
BoCoV	YAWLSYYVPS VEYTYTDEVI YGMLLLIGMV FVTLRSINHD LFSFIMFVGR VISVVSLLWYM
MHV	YAWLSHFVPA VDYTYMDEV L YGVVLLVAMV FVTMRSINHD VFSVMFLVGR LVSLVSMWYF
AIPV	VIFLSQWYDP VVFDTMVPMW FLPLVLYTAF KCVQGCYMS FNTSLLMLYQ FVKLGFVIYT
SARS CoV	MTWLELADTS LSGYRLKDCV MYASALVLLI LMTARTVYDD AARRVWTLMN VITLVYKVYY

	4025 4035 4045 4055 4065 4075
EMCR	SGD----- FLSL LVMLFCAISS DWYIGAIVFR LSRLIIFFSP E---SVFSVF
229E	SYD----- YVSL LVMLLCAISN EWYIGAIIFR ICRFGVAFLP V---EYVSFY
PEDV	ASD----- ILSC AMTLFASVTG NWFVGAVCYK VAVYMALRFP ----TFVAIF
TGEV	SDPEWTENQI ---AFCFVNM LTMIVSLTTK DWMVVIASR IAYYIVVCVM P-S-AFVSDF
OC43	GSN----- LEEEL LMLASLFGT YTWTTVLSMA VAKVIKWA VNV-LYFTDI
BoCoV	GSN----- LEEEL LMLASLFGT YTWTTALSMA AAKVIKWA VNV-LYFTDI
MHV	GAN----- LEEEV LFLTSLFGT YTWTTMLSLA TAKVIKWA VNV-LYFTDI
AIPV	SSNTLTAYTE GNWELFFELV HTTVLANVSS NSLIGLFVFK CAKWMLYYCN -----ATLV
SARS CoV	GNALD----- QAISM WALVISVTSN YSGVVTIMF LARAIVFVCV EYYPPLFITG

	4085 4095 4105 4115 4125 4135
EMCR	GDVKLTLLVY LICGYLVCTY WGLYWFNRF FKCTMGVYDF KVSAAEFKYM VANGLHAPYG
229E	DGVKTVLLFY MLLGFVSCMY YGLLYWINRF CKCTLGVDYF CVSPAEFKYM VANGLNAPNG
PEDV	GDIKSVMFY LVLYGYFTCCF YGLYWFNRF FKVSUGVYDY TVSAAEFKYM VANGLRAPTG
TGEV	GFMKCISIVY MACGYLFCCY YGLYWFNRF TCMTCGVYQF TVSAAELKYM TANNLSAPKN
OC43	PQIKIVLLCY LFIGYIISCY WGLFSLMNSL FRMPLGVYNY KISVQELRYM NANGLRPPKN
BoCoV	PQIKIVLCY LFIGYIISCY WGLFSLMNSL FRMPLGVYNY KISVQELRYM NANGLRPPKN
MHV	PQVKLVLLSY LCIGYVCCY WGLVSLLSI FRMPLGVYNY KISVQELRYM NANGLRPPKN
AIPV	NNYVLMAMV NCIGWLCTCY FGLYWWNVK FGLTLGKYNF KVSVDQYRYM CLHKINPKT
SARS CoV	NTLQICMLVY CFLGYCCCCY FGLFLLNRY FRLTLGVYDY LVSTQEFYRYM NSQGLLPPKS

	4145 4155 4165 4175 4185 4195
EMCR	PFDAWLSEFK LLGIGGDRCI KISTVQSKLT DLKCTNVVLL GCLSSMNIAA NSSEWAYCVD
229E	PFDAFLSEFK LMGIGGPRTI KVSTVQSKLT DLKCTNVVLL GILSNMNTAS NSKEWAYCVD
PEDV	TLDSLILLSAK LIGIGGERNI KISSVQSKLT DIKCSNVVLL GCLSSMNVSA NSTEWAYCVD
TGEV	AYDAMILSAK LIGVGGKRN KISTVQSKLT EMKCTNVVLL GLLSKMHVES NSKEWNYCVG
OC43	SFEALMLNFK LLGIGGVPII EVSQFQSKLT DVKCANVLL NCLQHLHVAS NSKLWHYCT
BoCoV	SFEALMLNFK LLGIGGVPII EVSQFQSKLT DVKCANVLL NCLQHLHVAS NSKLWHYCT
MHV	SFEALVLFNFK LLGIGGVPII EVSQFQSKLT DVKCANVLL NCLQHLHVAS NSKLWHYCT
AIPV	VWEVFSTNLI IQGIGGDRVL PIATVQAKLS DVKCTTVVLL QLLTKLNVEA NSKMHVLYE
SARS CoV	SIDAFKLNK LLGIGGKPCI KVATVQSKMS DVKCTSVVLL SVLQQLRVES SSKLWAOQCVQ

	4205 4215 4225 4235 4245 4255
EMCR	LHNKINLCDD PEKAQGMLLA LLAFFLSKHS DFG-----L DGLIDSYFDN SSTLQSVASS
229E	MHNKINLCDD PETAQELLLA LLAFFLSKHS DFG-----L GDLVDSYFEN DSILQSVASS
PEDV	LHNKINLCDD PEKAQEMLLA LLAFFLSKHS AFG-----L DDLLESYFND NSMLQSVAST
TGEV	LHNEINLCDD PEIVLEKLLA LLAFFLSKHN TCD-----L SELIESYFEN TTILQSVASA
OC43	LHNEILATSD LSAFAFEKLAQ LLIVLFANPA AVDSKCLTSI EEVCDDYAKD NTVLQALQSE
BoCoV	LHNEILATSD LGVAFELKLAQ LLIVLFANPA AVDSKCLTSI EEVCDDYAKD NTVLQALQSE
MHV	LHNEILATSD LSAVAFDKLAQ LLVVLFFANPA AVDSKCLAS EEVCDDYAKD STVLQALQSE
AIPV	LHNKILASDD VGECDNLLK MLITLFCIDS TID-----L SEYCDILKR STVLQALQSE
SARS CoV	LHNDILLAKD TTEAFKEMVS LLSVLLSMQG AVD-----I NRICEEMLDN RATLQAIASE

	4265 4275 4285 4295 4305 4315
EMCR	FVSMPSYIAY ENARQAYEDA IANGSS---- SQLIKQLKRA MNIKSEFDH EISVQKKINR
229E	FVGMPSPFVAY ETARQEYENA VANGSS---- PQIIKQLKKA MNVAKAEFDR ESSVQKKINR
PEDV	YVGLPSYVIY ENARQYEDA VNNGSP---- PQLVKQLRHA MNVAKSEFDR EASTQRKLD
TGEV	YAALPSWIAL EKARADLEEA KKNDVS---- PQILKQLTKA FNIKASDFER EASVQKKLDK
OC43	FVNMAFVEY EVAKKNLDEA RFGSGAN--- QQQLKQLEKA CNIKASAYER DRAVAKKLER
BoCoV	FVNMAFVEY EVAKKNLDEA CSSGSAN--- QQQLKQLEKA CNIKASAYER DRAVAKKLER
MHV	FVNMAFVEY ELAKKNLDEA KAGSGAN--- QQQLKQLEKA CNIKASAYER DRAVAKKLER
AIPV	FSHIPSYAEY ERAKNLYEKV LVDSKNGGVT QQELAAYRKA ANIAKSVFDR DLAVQKKLDS
SARS CoV	FSSLPSYAA ATAQEAYEQA VANGDS---- EVVLKLLKKS LNVAKSEFDR DAAMQRKLEK

	4325 4335 4345 4355 4365 4375
EMCR	MAEQAAATQMY KEARSVNRS KVISAMHSL FGMLRRRLDMS SVETVLNLAR DGVVPLSVIP
229E	MAEQAAAQMY KEARAVNRKS KVSAMHSL FGMLRRRLDMS SVDITLNMAR NGVPLSVIP
PEDV	MAEQAAAQMY KEARAVNRKS KVSAMHSL FGMLRRRLDMS SVDITLNLAK DGVVPLSVIP
TGEV	MAEQAAAQMY KEARAVDRKS KVISAMHSL FGMLRRRLDMS SVNTIIDQAR NGVPLSVIP
OC43	MADLALTMY KEARINDKKS KVSALQTM FGMLRRRLDMS ALNSILDNAV KGCVPPLNAIP
BoCoV	MADLALTMY KEARINDKKS KVSALQTM FGMLRRRLDMS ALNSILDNAV KGCVPPLNAIP
MHV	MADLALTMY KEARINDKKS KVSALQTM FGMLRRRLDMS ALNSILDNAV KGCVPPLNAIP
AIPV	MAERAMTMY KEARVTDRA KLVSSLHALL FSMLKKIDSE KLVNLFDOAS SGVPLATVP
SARS CoV	MADQAMTMY KQARSEDKRA KVSAMQTM FTMLRRRLDMS ALNNIINNAR DGCVPPLNAIP

	4385	4395	4405	4415	4425	4435
EMCR	ATSASKLTIV	SPDLESYSKI	VCDGSVHYAG	VVWTLNDVKD	NDGRPVHVKE	ITR-----EN
229E	ATSAARLVV	VPDHSFVKM	MVDGFVHYAG	VVWTLQEVKD	NDGKNVHLKD	VTK-----EN
PEDV	AVSATKLNIV	TSDIDSYNRI	QREGCVHYAG	TIWNIIDIKD	NDGKVVHVKE	VTA-----QN
TGEV	AASATRLVVI	TPSLEVFSKI	RQENNVHYAG	AIWTIVEVKD	ANGSHVHLKE	VTA-----AN
OC43	SLAANTLNII	VPDKSVYDQV	VDNVVVTYAG	NVWQIQTIQD	SDGTNKQLNE	IS-----
BoCoV	SLAANTLTII	VPDKSVYDQV	VDNVVVTYAG	NVWQIQTIQD	SDGTNKQLHE	IS-----
MHV	SLTSNTLTII	VPDKQVFDQV	VDNVVVTYAG	NVWHIQSIQD	ADGAVKQLNE	ID-----
AIPV	IVCSNKLTIV	IPDPETWVKC	VEGVHVTYST	VVWNIDTVID	ADGTELHPTS	TGSGLTTCIS
SARS CoV	LTTAAKLMV	VPDYGTYKNT	CDGNTFTYAS	ALWEIQQVVD	ADSKIVQLSE	INM-----DN

	4445	4455	4465	4475	4485	4495
EMCR	VETLTPWLIL	NCER-----	VVKLQNNNEIM	PGKLRQKPMK	AEG--DGGVL	GDGNALYNTE
229E	QEILVWPLIL	TCER-----	VVKLQNNNEIM	PGKMKVKATK	GEG--DGGIT	SEGNALYNNE
PEDV	AESLSWPLVL	GCER-----	IVKLQNNNEII	PGKLRQRSIK	AEG--DG-IV	GEGKALYNNE
TGEV	ELNLTWPLSI	TCER-----	TTKLQNNNEIM	PGKLRKRAVR	ASATLDGEAF	SGSKALMASE
OC43	-DDCNWPLVI	IANRY-NEVS	ATVLQNNNELM	PAKLKIQVNV	SGP--DQTCN	TPTQCYNNNS
BoCoV	-DDCNWPLVI	IANRH-NEVS	ATVLQNNNELM	PAKLKTQVNV	SGP--DQTCN	TPTQCYNNNS
MHV	-VNITWPLVI	AANRH-NEVS	SVVLQNNNELM	PQKLRTQVNV	SGS--DMNCN	TPTQCYNTT
AIPV	GANIAWPLKV	NLTRNGHNKV	DVVLQNNNELM	PHGVKTKACV	AGVD-QAHCS	VESKCYTNI
SARS CoV	SPNLAWPLIV	TALRA-N--S	AVKLQNNNELS	PVALRQMSCA	AGTTQTACTD	DNALAYNNNS

	4505	4515	4525	4535	4545	4555
EMCR	GGKTFMYAYI	SNKADLKFKV	WEY-EGG-CN	TIELDSPCRF	MVETPNGPQV	KYLYFVKNLN
229E	GGRAFMYAYV	TTKPGMKYVK	WEH-DSG-VV	TVELEPPCRF	VIDTPTGPQI	KYLYFVKNLN
PEDV	GGRTFMYAFI	SDKPDLRVVK	WEF-DGG-CN	TIELEPPRKF	LVDSPNGAQI	KYLYFVRNLN
TGEV	SGKSFMYAFI	ASDNNLKYYK	WES-NND-II	PIELEAPLRF	YVDGANGPEV	KYLYFVKNLN
OC43	NNGKIVYAIL	SDVDGLKYTK	ILKDDGN-FV	VLELDPPCKF	TVQDAKGLKI	KYLYFVKGCN
BoCoV	YNGKIVYAIL	SDVDGLKYTK	ILKDDGN-FV	VLELDPPCKF	TVQDVKGLKI	KYLYFVKGCN
MHV	GMGKIVYAIL	SDCDGLKYTK	IVKDEGN-CV	VLELDPPCKF	SVQDVKGLKI	KYLYFVKGCN
AIPV	SGNSVVAAIT	SSNPNLKVAS	FLNEAGN-QI	YVDLDPPCKF	GMKVGKVEV	VYLYFIKNT
SARS CoV	KGGRFVLALL	SDHQDLKWAR	FPKSDGTGTI	YTELEPPCRF	VTDTPKGPKV	KYLYFIKGLN

	4565	4575	4585	4595	4605	4615
EMCR	TLRRGAVLGF	IGATIRLQAG	-KQTELAVNS	GLLTACAFSV	DPATTYLEAV	KHGAKPVSN
229E	NLRRGAVLGY	IGATVRLQAG	-KQTEFVSNS	HLLTHCSFAV	DPAAAYLDAV	KQGAKEPVNC
PEDV	TLRRGAVLGY	IGATVRLQAG	-KQTEFVSNS	SLLTLCAFAV	DPAKTYIDAV	KSGHKPVGNC
TGEV	TLRRGAVLGY	IGATVRLQAG	-KPTHEPSNS	SLLTLCAFSF	DPAKAYVDAV	KRGMQPVNNC
OC43	TLARGWVVGT	ISSTVRLQAG	-TATEYASNS	SILSLCAFSV	DPKKTLYLDFI	QGGGTPIANC
BoCoV	TLARGWVVGT	ISSTVRLQAG	-TATEYASNS	SILSLCAFSV	DPKKTLYLDFI	QGGGTPIANC
MHV	TLARGWVVGT	LSSTVRLQAG	-TATEYASNS	AIRSLCAFSV	DPKKTLYLDYI	QGGGAPVTNC
AIPV	SIVRGMVLGA	ISNVVVLQSK	GHETEEDDAV	GILSLCSFAV	DPADTYCKYV	AAGNQPLGNC
SARS CoV	NLNRGMVLGS	LAATVRLQAG	-NATEVPANS	TVLSFCAFAV	DPAKAYKDYL	ASGGQPIITNC

	4625	4635	4645	4655	4665	4675
EMCR	IKMLSNAGAG	GQAITSVDA	NTNQDSYGGA	SICLYCRAHV	PHP-----SMD	GYCKFKGKCV
229E	VKMLTNGSGS	GQAITCTIDS	NTTQDTYGGA	SVCICYCRAHV	AHP-----TMD	GFCQYKQKVV
PEDV	VKMLANGSGN	GQAVTNGVEA	STNQDSYGGA	SVCLYCRAHV	EHP-----SMD	GFCRLKQKVV
TGEV	VKMLSNAGAG	GMAVTNGVEA	NTQDQSYGGA	SVCICYCRHV	EHP-----AID	GLCRYKQKVV
OC43	VKMLCDHAGT	GMAITVKPDA	TTSQDSYGGA	SVCICYCRARV	EHP-----DVD	GLCKLRGKVV
BoCoV	VKMLCDHAGT	GMAITVKPDA	TTSQDSYGGA	SVCICYCRARV	EHP-----DVD	GLCKLRGKVV
MHV	VKMLCDHAGT	GMAITIKPEA	TTNQDSYGGA	SVCICYCRSRV	EHP-----DVD	GLCKLRGKVV
AIPV	VKMLTVHNGS	GFAITSKPSP	TPDQDSYGGA	SVCLYCRAHI	AHPGSVGNLD	GRCQFKGSFV
SARS CoV	VKMLCTHTGT	GQAITVTPEA	NMDQESFGGA	SCCLYCRAHI	DHP-----NPK	GFCDLKQKVV

	4685	4695	4705	4715	4725	4735
EMCR	QVPIGCL-DP	IRFCLENNVC	NVCGCWLGHG	CACDRTTIQS	-----	-VDISYLNQ
229E	QVPIGTN-DP	IRFCLENTVC	KVCGCWLNHG	CTCDRTAIQS	-----	-FDNSYLNQ
PEDV	QVPLGTN-DP	IRFVLENDVC	KVCGCWLNSG	CTCDRSIMQS	-----	-T-----
TGEV	QIPTGTQ-DP	IRFCIENEVC	VVCGCWLNNG	CMCDRTSMQS	F-----	TVDQSYLNQ
OC43	QVPVGIK-DP	VSYVLTHDVC	RVCGFWRDGS	CSCVSTDTTV	Q-----	SKDT-----
BoCoV	QVPVGIK-DP	VSYVLTHDVC	RVCGFWRDGS	CSCVSTDTTV	Q-----	SKDTNLFNGF
MHV	QVPLGIK-DP	VSYVLTHDVC	QVCGFWRDGS	CSCVGTGSQF	Q-----	SKDTNLFNGF
AIPV	QIPTTEK-DP	VGFCRLRNKVC	TVCQCWIGYG	CQCDSLRLPK	SSVQSVAGAS	DFDKNYLNGY
SARS CoV	QIPTTCANDP	VGFTLRNTVC	TVCGMWKGYG	CSCDQLREPL	M-----	QSADASTFLN

	4745
EMCR	GVLVQLD
229E	GALVPLD
PEDV	-----
TGEV	GVLVQLD
OC43	-----
BoCoV	GVRV----
MHV	GVQV----
AIPV	GVAVRLG
SARS CoV	GFAV----

C. Putative orf 1b

	5	15	25	35	45	55
EMCR	-----	-----	RARGSSAARL	EPCN-GTDID	KCVRAFDIYN	KNVSFLGKCL
229E	-----	-----	-----	EPCN-GTDID	YCVRAFDVYN	KDASFIGKNL
PEDV	-----	-----YGLFK	RVRGSSAARL	EPCN-GTDTQ	HVYRAFDIYN	KDVACLKFL
TGEV	-----	-----	-----	EPCN-GTDPD	HVSRAFDIYN	KDVACIGKFL
BoCoV	-----	-----FFKR	VRGTSVDARL	VPCASGLSTD	VQLRAFDICN	ASVAGIGLHL
OC43	-----	-----FFKR	VRGTSVDARL	VPCASGLSTD	VQLRAFDIYN	ASVAGIGLHL
MHV	LFLCRHRLPV	SVKRHELFFKR	VRGTSVNARL	VPCASGLSTD	VQLRAFDICN	ANRAGIGLYY
AIPV	-----	-----	-----	-----	-----	-----MFQNL
SARS CoV	-----	-----	-----	TPCGTGTSTD	VVYRAFDIYN	EKVAGFAKFL
	65	75	85	95	105	115
EMCR	KMNCVRFKNA	-----DL	KDGYFVIKRC	TKSVMEHEQS	MYNLLNFSGA	LAEHDFFTWK
229E	KSNCVRFKNV	-----DK	DDAFYIVKRC	IKSVMDEHQS	MYNLLKGCNA	VAKHDFFTWH
PEDV	KVNCVRLKNL	-----DK	HDAFYIVKRC	TKSMEHEQS	IYSRLEKCGA	IAEHDFFTWK
TGEV	KTNCSEFRNL	-----DK	HDAFYIVKRC	TKTVMDHEQV	CYNDLKDSGA	VAEHDFFTYK
BoCoV	KVNCCRFQRV	--DENG--DK	LDQFFVVKRT	DLTIYNREME	CYERVKCKF	VAEHDFFTFD
OC43	KVNCCRFQRV	--DENG--DK	LDQFFVVKRT	DLTIYNREME	CYERVKCKF	VAEHDFFTFD
MHV	KVNCCRFQRA	--DEDG--NT	LDKFFVIKRT	NLEVYNKEKE	CYELTKECGV	VAEHDFFTFD
AIPV	KRNCCRFQEL	RDTEGDNLEY	LDSYFVVKQT	TPSNYEHEKS	CYEDLKS-EV	TADHDFVFN
SARS CoV	KTNCCRFQEK	--DEEG--NL	LDSYFVVKRH	TMSNYQHEET	IYNLVKDCPA	VAVHDFFKFR
	125	135	145	155	165	175
EMCR	DGRVIYGNVS	RHNLTKYTMM	DLVYAMRNFD	EQNCDELKEV	LVLGTCCDNS	----YFDSKG
229E	EGRTIYGNVS	RQDLTKYTMM	DLCFALRNFD	EKDCEVKEI	LVLGTCCSTD	----YFEMKN
PEDV	DGRAIYGNVC	RKDLTEYTMM	DLCYALRNFD	ENNCDELKSI	LKVGACEES	----YFNKVV
TGEV	EGRCFEGNVA	RRNLTKYTMM	DLCYALRNFD	EKNCEVLKEI	LVTVGACTEE	----FFENKD
BoCoV	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCMMLCDI	LSIYAGCEQS	----YFTKKD
OC43	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCMMLCDI	LSIYAGCEQS	----YFTKKD
MHV	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCTLKEI	LLTYAECDES	----YFQKKD
AIPV	KN---IYNIS	RQRLTKYTMM	DFCYALRHFD	PKDCEVLKEI	LVTYGCIEDY	HPKWFEENKD
SARS CoV	VDGDMVPHIS	RQRLTKYTMA	DLVYALRHFD	EGNCDTLKEI	LVTYNCCDD	----YFNKDD
	185	195	205	215	225	235
EMCR	WYDFVENEDI	HRVYASLGKI	VARAMLKCA	LCDAMVAKGV	VGVLTLDNQD	LNGNFYDFGD
229E	WFDPIENEDI	HRVYALGKV	VANAMLKCA	FCDEMVLKGV	VGVLTLDNQD	LNGNFYDFGD
PEDV	WFDPVENEDI	HRVYALGTI	VARAMLKCVK	FCDAMVEQGI	VGVLTLDNQD	LNGNFYDFGD
TGEV	WFDPVENEAI	HEVYAKLGPI	VANAMLKCA	FCDALVEKGY	IGVITLDNQD	LNGNFYDFGD
BoCoV	WYDFVENPDI	INVYKKGPI	FNRLVSATE	FADKLVEVGL	VGILTLDNQD	LNGKWFDFGD
OC43	WYDFVENPDI	INVYKKGPI	FNRLVSATE	FADKLVEVGL	VGVLTLDNQD	LNGKWFDFGD
MHV	WYDFVENS DI	INVYKKGPI	FNRLVNTAK	FADTLVEAGL	VGVLTLDNQD	LYGQWYDFGD
AIPV	WYDFPIENSKY	YVMLAKMGPI	VRRLALNAIE	FGNLMVEKGY	VGVLTLDNQD	LNGKWFDFGD
SARS CoV	WYDFVENPDI	LRVYANLGER	VRQSLKTVQ	FCDAMRDAGI	VGVLTLDNQD	LNGNWFDFGD
	245	255	265	275	285	295
EMCR	FVVSPLNMGV	PCCTSYYSYM	MPIMGLTNCL	ASECFVKSDI	FGSDFKTFDL	LKYDFTEHKE
229E	FVLCPPGMGI	PYCTSYYSYM	MPVMGMTNCL	ASECFMKSDI	FGQDFKTFDL	LKYDFTEHKE
PEDV	FTCSIKGMGV	PICTSYYSYM	MPVMGMTNCL	ASECFVKSDI	FGEDFKSYDL	LEYDFTEHKT
TGEV	FVKTAPGFGC	ACVTSYYSYM	MPLMGMTSCL	ESENFVKSDI	YGS DYKQYDL	LAYDFTEHKE
BoCoV	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNNAY	R-----LFDL	VQYDFTDYKL
OC43	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNNAY	R-----LFDL	VQYDFTDYKL
MHV	FVKTVP GCGV	AVADSYYSYM	MPMLTMCHAL	DSELFINGTY	R-----EFDL	VQYDFTDYKL
AIPV	FQKTAPGAGV	PVFDYYSYM	MPPIAMTDAL	APERYFEYDV	HKG-YKSYDL	LKYDYTEEKQ
SARS CoV	FVQVAPGCGV	PIVDSYYSLL	MPILT LTRAL	AAESHMDADL	AKP-LIKWDL	LKYDFTEERL
	305	315	325	335	345	355
EMCR	NLFNKYFKHW	SFDYHPNCSD	CYDDMCVIHC	ANFNLTLFATT	IPGTAFGPLC	RKVFDIGVPL
229E	VLFNKYFKYW	GQDYHPDCVD	CHDEMCI LHC	SNFNLTLFATT	IPNTAFGPLC	RKVFDIGVPL
PEDV	ALFNKYFKYW	GLQYHPNCVD	CSDEQCI VHC	ANFNLTFTT	IPITAFGPLC	RKCWIDGVPL
TGEV	YLFQKYFKYW	DRTYHPNCSD	CTSDECI IHC	ANFNLTFSMT	IPMTAFGPLV	RKVHIDGVPL
BoCoV	ELFNKYFKHW	SMPYHPNTVD	CQDDRCI IHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
OC43	ELFNKYFKHW	SMPYHPNTVD	CQDDRCI IHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
MHV	ELFNKYFKYW	SMTYHPNTCE	CDDRCI IHC	ANFNILFSMV	LPKTCFGPLV	RQIFVDGVPP
AIPV	ELFQKYFKYW	DQYHPNCRD	CSDRCI IHC	ANFNILFSTL	IPQTSFGNLC	RKVFDGVPP
SARS CoV	CLFDRYFKYW	DQYHPNCIN	CLDDRCI LHC	ANFNVLFTV	FPPTSFGPLV	RKIFVDGVPP

	365	375	385	395	405	415
EMCR	VTTAGYHFKQ	LGLVWNKDVN	THSVRLTITE	LLQFVTDPSL	IIASSPALVD	QRTICFSVAA
229E	VATAGYHFKQ	LGLVWNKDVN	THSTRLTITE	LLQFVTDPTL	IVASSPALVD	KRTVCFVSAA
PEDV	VTTAGYHFKQ	LGIWVNNDLN	LHSSRLSINE	LLQFCSDPAL	LIASSPALVD	QRTVCFVSAA
TGEV	VVTAGYHFKQ	LGIWVNLQVK	LDTMKLSMTD	LLRFVTDPTL	LVASSPALLD	QRTVCFVSIAA
BoCoV	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD	LRTCCFSVAA
OC43	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD	LRTCCFSVAA
MHV	VVSIGYHYKE	LGVVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALLD	LRTCCFSVAA
AIPV	IATCGYHSKE	LGVIMNQDNT	MSFSKMGLSQ	LMQFVGDPAL	LVGTSNNLVD	LRTSCFSVCA
SARS CoV	VVSTGYHFRE	LGVVHNQDVN	LHSSRLSFKE	LLVYAADPAM	HAASGNLLLD	KRTTCFSVAA

	425	435	445	455	465	475
EMCR	LSTGLTNQVV	KPGHFNEEFY	NFLRLRGFFD	EGSELTLKHF	FFAQNGDAAV	KDFDFYRYNK
229E	LSTGLTSQTV	KPGHFNKEFY	DFLRSQGFDD	EGSELTLKHF	FFTQKGDAAI	KDFDYRYRNR
PEDV	LGTGMTNQTV	KPGHFNKEFY	DFLLEQGFSS	EGSELTLKHF	FFAQKVDAAV	KDFDYRYRNR
TGEV	LSTGITYQTV	KPGHFNKDFY	DFITERGFFE	EGSELTLKHF	FFAQGGGAAM	TDFNYRYRNR
BoCoV	ITSGVKFQTV	KPGNFNQDFY	DFILSKGLLK	EGSSVDLKHF	FFTQDGNAAI	TDYNYKYRNL
OC43	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKHF	FFTQDGNAAI	TDYNYKYRNL
MHV	ITSGVKFQTV	KPGNFNQDFY	EFILSKGLLK	EGSSVDLKHF	FFTQDGNAAI	TDYNYKYRNL
AIPV	LTSGITHQTV	KPGHFNKDFY	DFAEKAGMFK	EGSSIPLKHF	FYPQTGNAAI	NDYDYRYRNR
SARS CoV	LTNNVAFQTV	KPGNFNKDFY	DFAVSKGFFK	EGSSVELKHF	FFAQDGNAAI	SDYDYRYRNL

	485	495	505	515	525	535
EMCR	PTILDICQAR	VTYKIVSRYF	DIYEGGCICA	CEVVVTNLNK	SAGWPLNKFG	KASLYYESIS
229E	PTMLDIGQAR	VAYQVAARYF	DCYEGGCITS	REVVVTNLNK	SAGWPLNKFG	KAGLYYESIS
PEDV	PTVLDICQAR	VVYQIVQRYF	DIYEGGCITA	KEVVVTNLNK	SAGYPLNKFG	KAGLYYESLS
TGEV	PTVLDICQAR	FVYKIVGKYF	ECYDGGCINA	REVVVTNYDK	SAGYPLNKFG	KARLYYETLS
BoCoV	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	AQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
OC43	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	SQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
MHV	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	TQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
AIPV	PTMFIDICQLL	FCLEVTSKYF	ECYEGGCIPA	SQVIVNNLKD	SAGYPFNKFG	KARLYYE-MS
SARS CoV	PTMCDIRQLL	FVVEVVDKYF	DCYDGGCINA	NQVIVNNLKD	SAGFPFNKFG	KARLYYDSMS

	545	555	565	575	585	595
EMCR	YEEQDALFAL	TKRNVLPMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ	YHOKHLKSIV
229E	YEEQDAIFSL	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLATMTTRQ	FHQKCLKSIV
PEDV	YEEQDELAY	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ	YHOKHLKSIV
TGEV	YEEQDALFAL	TKRNVLPMT	QMNLYKAISG	KARARTVGGV	SLLSTMTTRQ	YHOKHLKSIA
BoCoV	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
OC43	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
MHV	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
AIPV	LEEQDLFEI	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTNRQ	FHQKILKSIV
SARS CoV	YEDQDALFAY	TKRNVIPMT	QMNLYKAISA	KNRARTVAGV	SICSTMTNRQ	FHQKILKSIA

	605	615	625	635	645	655
EMCR	NTRNATVVIG	TTKFYGGWNN	MLRTLIDGVE	NPMLMGWDYP	KCDRALPNMI	RMISAMVLGS
229E	ATRNATVVIG	TTKFYGGWNN	MLKLNLMADVD	DPKLMGWDYP	KCDRAMPSMI	RMISAMVLGS
PEDV	NTRGASVVIG	TTKFYGGWNN	MLKLNLDGVE	NPCLMGWDYP	KCDRALPNMI	RMISAMVLGS
TGEV	ATRNATVVIG	STKFYGGWNN	MLKLNLMRDVD	NGCLMGWDYP	KCDRALPNMI	RMASAMVLGS
BoCoV	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	NPVLMGWDYP	KCDRAMPNIL	RIVSSLVLAR
OC43	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	NPVLMGWDYP	KCDRAMPNIL	RIVSSLVLAR
MHV	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	SPVLMGWDYP	KCDRAMPNIL	RIISSLVLAR
AIPV	NTRNASVVIG	TTKFYGGWNN	MLRNLQGVVE	DPILMGWDYP	KCDRAMPNIL	RIAASLVLAR
SARS CoV	ATRGATVVIG	TSKFYGGWNN	MLKTVYS DVE	TPHLMGWDYP	KCDRAMPNML	RIMASLVLAR

	665	675	685	695	705	715
EMCR	KHVNCTVTD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDASTAYA	NSIFNIFQAV
229E	KHVTCTASD	KFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA	NSVFNIFQAV
PEDV	KHTTCCSSTD	RFFRLCNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA	NSVFNIFQAV
TGEV	KHVGCTTHND	RFYRLSNELA	QVLTEVVHCT	GGFYFKPGGT	TSGDGTATAYA	NSAFNIFQAV
BoCoV	KHEACCSQSD	RFYRLANCA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
OC43	KHETCCSQSD	RFYRLANCA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
MHV	KHDSCCSHTD	RFYRLANCA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
AIPV	KHTNCCSWSE	RIYRLYNECA	QVLSEIVLAT	GGIYVKPGGT	SSGDATTAYA	NSVFNIQAT
SARS CoV	KHNTCCNLSH	RFYRLANCA	QVLSEIVMCG	GSLYVKPGGT	SSGDATTAYA	NSVFNICQAV

	725	735	745	755	765	775
EMCR	SSNINRLLSV	PSDSCNNVNV	RDLQRLLYDN	CYRLTSVEES	FIDDDYGYLR	KHFSMMILSD
229E	SSNINCVLSV	NSSNCNNFNV	KKLQRLQYDN	CYRNSNVDES	FVDDFYGYLR	KHFSMMILSD
PEDV	SANVNKLLSV	DSNVCHNLEV	KQLQRLKYEC	CYRSTIVDDQ	FVVEYGYLR	KHFSMMILSD
TGEV	SANVNKLLGV	DSNACNNVTV	KSIQRLKYDN	CYRSSSIDEE	FVVEYFSYLR	KHFSMMILSD
BoCoV	SANVCALMSC	NGNKIEDLSI	RALQRLYSH	VYRSDMVDST	FVTEYEFYLR	KHFSMMILSD
OC43	SANVCALMSC	NGNKIEDLSI	RALQRLYSH	VYRSDKVDST	FVTEYEFYLR	KHFSMMILSD
MHV	SANVCSLMAC	NGHKIEDLSI	RELQRLYSH	VYRADHVDPA	FVNEYEFYLR	KHFSMMILSD
AIPV	SANVARLLSV	ITRDIVYDNI	KSLQRLYQQ	VYRRVNFDP	FVEKFYSYLR	KHFSMMILSD
SARS CoV	TANVNALLST	DGNKIADKYV	RNLQRLKYEC	LYRNRDVDHE	FVDEFYAYLR	KHFSMMILSD

	785	795	805	815	825	835
EMCR	DGVVCYNKDY	AELGYIADIS	AFKATLYYQN	NVFMSTSKCW	VEEDLTGKPH	EFCSQHTMQI
229E	DSVVVCYNKTY	AGLGYIADIS	AFKATLYYQN	GVFMSTAKCW	TEEDLSIGPH	EFCSQHTMQI
PEDV	DGVVCYNNDY	ASLGYVADLN	AFKAVLYYQN	NVFMSTASKCW	IEPDINKGPH	EFCSQHTMQI
TGEV	DGVVCYNKDY	ADLGYVADIN	AFKATLYYQN	NVFMSTSKCW	VEPDLSVGPH	EFCSQHTLQI
BoCoV	DGVVCYNSDY	ASKGYIANIS	AFQQVLYYQN	NVFMSESKCW	VENDINNGPH	EFCSQHTMLV
OC43	DGVVCYNSDY	ASKGYIANIS	AFQQVLYYQN	NVFMSESKCW	VEHDINNGPH	EFCSQHTMLV
MHV	DGVVCYNSEF	ASKGYIANIS	AFQQVLYYQN	NVFMSEAKCW	VETDIEKGP	EFCSQHTMLV
AIPV	DGVVCYNNLT	AKQGLVADIS	GFREVLYYQN	NVFMADSKCW	VEPDLEKGP	EFCSQHTMLV
SARS CoV	DAVVCYNSNY	AAQGLVASIK	NFKAVLYYQN	NVFMSEAKCW	TETDLTKGPH	EFCSQHTMLV

	845	855	865	875	885	895
EMCR	VDKDGTYTYP	YPDPSRILSA	GVFVDDVVK	DAVLLXRYV	SLAIDAYPLS	KHPNSEYRKV
229E	VDENGKYTYP	YPDPSRIISA	GVFVDDITKT	DAVILLERYV	SLAIDAYPLS	KHPKPEYRKV
PEDV	VDKEGTYYLP	YPDPSRILSA	GVFVDDVVK	DAVLLERYV	SLAIDAYPLS	KHENPEYKKV
TGEV	VGPDDGYTYP	YPDPSRILSA	GVFVDDIVKT	DNVIMLERYV	SLAIDAYPLT	KHPKPAYQKV
BoCoV	KMDGDDVYLP	YPVPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV	YHENEYQKV
OC43	KMDGDDVYLP	YPNPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV	YHENEYQKV
MHV	KMDGDEVYLP	YPDPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV	YHENPEYQNV
AIPV	EVDGEPKYLP	YPDPSRILGA	GVFVDDVVK	EPVAVMERYI	ALADAYPLV	HHENEYKKV
SARS CoV	KQGDYVYLP	YPDPSRILGA	GCFVDDIVKT	DGTLMIERFV	SLAIDAYPLT	KHPNQEYADV

	905	915	925	935	945	955
EMCR	FYLLLDWVKH	LNKNLNEGV	ESFSVTLLED	QEDKFWCEDF	YASMYENSTI	LQAAGLCVVC
229E	FYALLDWVKH	LNKTLNEGV	ESFSVTLLED	HESKFWDESF	YASMYEKSTV	LQAAGLCVVC
PEDV	FYVLLDWVKH	LYKTLNAGVL	ESFSVTLLED	STAKFWDESF	YANMYEKSAV	LQSAGLCVVC
TGEV	FYTLLDWVKH	LQKNLNAAGVL	DSFSVTMLLE	GQDKFWSEEF	YASLYEKSTV	LQAAGMCVVC
BoCoV	FRVLEYIKK	LYNELGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV	MQSVGACVVC
OC43	FRVLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV	MQSVGACVVC
MHV	FRVLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDETF	YKNMYLRSV	MQSVGACVVC
AIPV	FFVLLAYIRK	LYQELSONML	MDYSFVMDID	KGSKFWEQEF	YENMYRAPPT	LQSCGVVCVVC
SARS CoV	FHLYLQYIRK	LHDELTHGML	DMYSVMLTND	NTSRYWEPEF	YEAMYPHTV	LQAVGACVLC

	965	975	985	995	1005	1015
EMCR	GSQTVLRCDG	CLRRPMLCTK	CAYDHVFGTD	HKFILAITPY	VCNASGCGVS	DVKKLYLGGL
229E	GSQTVLRCDG	CLRRPMLCTK	CAYDHVFGTD	HKFILAITPY	VCNTSGCNVN	DVTKLYLGGL
PEDV	GSQTVLRCDG	CLRRPMLCTK	CAYDHVIGTT	HKFILAITPY	VCCASDCGVN	DVTKLYLGGL
TGEV	GSQTVLRCDG	CLRRPLLCTK	CAYDHVMGKT	HKFIMSITPY	VCSFNGCNVN	DVTKLFLGGL
BoCoV	SSQTSRLRGS	CIRKPLLCKC	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN	DVTKLYLGGM
OC43	SSQTSRLRGS	CIRKPLLCKC	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN	DVTKLYLGGM
MHV	SSQTSRLRGS	CIRKPLLCKC	CAYDHVMSTD	HKYVLSVSPY	VCNAPGCDVN	DVTKLYLGGM
AIPV	NSQTLRLCGN	CIRKPLLCKC	CCYDHVMHDT	HKNVLSINPY	ICSQGLCGEA	DVTKLYLGGM
SARS CoV	NSQTSRLRGA	CIRKPLLCKC	CCYDHVISTS	HKLVLVSNPY	VCNAPGCDVT	DVTQLYLGGM

	1025	1035	1045	1055	1065	1075
EMCR	NYCYTNHKKPQ	LSFPLCSAGN	IFGLYKNSAT	GSLDVEVFNR	LATSDWTDVR	DYKLANDVKD
229E	NYCYVDHKKPH	LSFPLCSAGN	VFGLYKSSAL	GSMIDIVFNK	LSTDWSDIR	DYKLANDAKE
PEDV	SYWCHCHKPR	LAFPLCSAGN	VFGLYKNSAT	GSPDVEDFNR	IATSDWTDVS	DYRLANDVKD
TGEV	SYCYMNHKKPQ	LSFPLCANGN	VFGLYKSSAV	GSEAVEDFNK	LAVSDWTNVE	DYKLANNVKE
BoCoV	SYCEDHKKPQ	YSFKLVMMNG	VFGLYKQSC	GSPYIDDFNR	IASCKWTDVD	DYILANECTE
OC43	SYCEDHKKPQ	YSFKLVMMGL	VFGLYKQSC	GSPYIDDFNR	IASCKWTDVD	DYILANECTE
MHV	SYCEDHKKPQ	YSFKLVMMNG	VFGLYKQSC	GSPYIDDFNR	IASCKWTEVD	DYVLANECTE
AIPV	SYFCGNHKKPK	LSIPLVSNGT	VFGLYRANCA	GSENVDDFNR	LATNWSIVE	PYILANRCS
SARS CoV	SYYCKSHKPP	ISFPLCANGQ	VFGLYKNTCV	GSDNVTDFNA	IATCDWNTAG	DYILANTCTE

	1085	1095	1105	1115	1125	1135
EMCR	TLRLFAAETI	KAKEESVKSS	YAFATLKEVV	GPKELLSWE	SGKVKPPLNR	NSVFTCFQIS
229E	SLRLFAAETV	KAKEESVKSS	YAYATLKEIV	GPKELLSWE	SGKAKPPLNR	NSVFTCFQIT
PEDV	SLRLFAAETI	KAKEESVKSS	YACATLHEVV	GPKELLSWE	VGRPKPPLNR	NSVFTCYHIT
TGEV	SLKIFAAETV	KAKEESVKSE	YAYAVLKEVI	GPKELVLSWE	ASKTKPPLNR	NSVFTCFQIS
BoCoV	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVKPPLNK	NYVFTGYHFT
OC43	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVKPPLNK	NYVFTGYHFT
MHV	RLKLFAAETQ	KATEESFKQC	YASATIREIV	SDRELILSWE	IGKVRPPLNK	NYVFTGYHFT
AIPV	SLRRFAAETV	KATEELHKKQ	FASAEVREVF	SDRELILSWE	PGKTRPPLNR	NYVFTGYHFT
SARS CoV	RLKLFAAETL	KATEETFKLS	YGIATVREVL	SDRELHLSWE	VGKPRPPLNR	NYVFTGYHFT

	1145	1155	1165	1175	1185	1195
EMCR	KDSKFQIGEF	IFEKVEYGS	TVTYKSTVTT	KLVPGMIFVL	TSHNVQPLRA	PTIANQEKYS
229E	KDSKFQVGEF	VFEKVDYGS	TVTYKSTATT	KLVPGMIFVL	TSHNVQPLRA	PTMANQEKYS
PEDV	KNTKFQIGEF	VFEKAEYDND	AVTYKTTATT	KLVPGMIFVL	TSHNVQPLRA	PTIANQERY
TGEV	KDTKIQLGEF	VFEQSEYGS	SVYYKSTSTY	KLTPGMIFVL	TSHNVQPLRA	PILVNQEKYN
BoCoV	KNGKTVLGEY	VFDKSEL-TN	GVYYRATTTY	KLSVGDVFL	TSHSVANLSA	PTLVPOENYS
OC43	KNGKTVLGEY	VFDKSEL-TN	GVYYRATTTY	KLSVGDVFL	TSHSVANLSA	PTLVPOENYS
MHV	KNGKTVLGEY	VFDKSEL-TN	GVYYRATTTY	KLSVGDVFL	TSHAVSSLSA	PTLVPOENYT
AIPV	RTSKVQLGDF	TFEKGEG-KD	VVYKATSTA	KLSVGDIFVL	TSHNVVSLVA	PTLVPOQNTFS
SARS CoV	KNSKVQIGEF	TFEKGDY-GD	AVVYRGTTTY	KLVNGDYFVL	TSHTVMPLSA	PTLVPOEHYV

	1205 1215 1225 1235 1245 1255
EMCR	SIYKLHPAFN VSDAYANLVP YYQLIGKQKI TTIQGGPPGSG KSHCSIGLGL YYPGARIVFV
229E	TIYKLHPSFN VSDAYANLVP YYQLIGKQRI TTIQGGPPGSG KSHCSIGIGV YYPGARIVFT
PEDV	TIHKLHPAFN IPEAYSSSLVP YYQLIGKQKI TTIQGGPPGSG KSHCVIGLGL YYPGARIVFT
TGEV	TISKLYPVFN IAEAYNTLVP YYQMIGKQKF TTIQGGPPGSG KSHCVIGLGL YYPGARIVFT
BoCoV	SIR-FASVYS VLETFQNNVV NYQHIGMKRY CTVQGGPPGTG KSHLAIGLAV YYCTARVVYT
OC43	SIR-FASVYS VLETFQNNVV NYQHIGMKRY CTVQGGPPGTG KSHLAIGLAV FYCTARVVYT
MHV	SIR-FASVYS VPETFQNNVP NYQHIGMKRY CTVQGGPPGTG KSHLAIGLAV YYCTARVVYT
AIPV	RFVNLRPVNM VPECFVNNIP LYHLVGKQKR TTVQGGPPGSG KSHFAIGLAV YFSSARVVFT
SARS CoV	RITGLYPTLN ISDEFSSNVA NYQKVGMMQKY STLQGGPPGTG KSHFAIGLAL YYPGARIVFT

	1265 1275 1285 1295 1305 1315
EMCR	ACAAHAVDSL CAKAMTVYSI DKCTRIIPAR ARVECYSGFK PNNTSAQYIF STVNALPECN
229E	ACSHAAVDSL CAKAVTAYSV DKCTRIIPAR ARVECYSGFK PNNTSAQYIF STVNALPEVN
PEDV	ACSHAAVDSL CVKASTAYSN DKCSRIIPQR ARVECYDGFK SNNTSAQYLF STVNALPECN
TGEV	ACSHAAVDAL CEKAAKNFNV DRCSRIIPQR IRVDCYTGFK PNNTSAQYLF CTVNALPEAS
BoCoV	AASHAAVDAL CEKAYKFLNI NDCTRIVPAK VRVECYDKFK INDTRKYVF TTINALPEMV
OC43	AASHAAVDAL CEKAYKFLNI NDCTRIVPAK VRVECYDKFK INDTRKYVF TTINALPEMV
MHV	AASHAAVDAL CEKAYKFLNI NDCTRIVPAK VRVDCYDKFK VNDTRKYVF TTINALPELV
AIPV	ACSHAAVDAL CEKAFKFLKV DDCTRIVPQR TTVDCFSKFK ANDTGKKYIF STINALPEVS
SARS CoV	ACSHAAVDAL CEKALKYLP I DKCSRIIPAR ARVECFDKFK VNSTLEQYVF CTVNALPETT

	1325 1335 1345 1355 1365 1375
EMCR	ADIVVVDEVS MCTNYDLSVI NQRLSYKHIV YVGDPQQLPA PRVMITKGVM EPVDYNVVTQ
229E	ADIVVVDEVS MCTNYDLSVI NQRISYKHIV YVGDPQQLPA PRVLISKGVM EPIDYNVVTQ
PEDV	ADIVVVDEVS MCTNYDLSVI NQRISYRHVV YVGDPQQLPA PRVMISRGTL EPKDYNVVTQ
TGEV	CDIVVVDEVS MCTNYDLSVI NSRLSYKHIV YVGDPQQLPA PRTLINKGVL QPQDYNVVTK
BoCoV	TDIVVVDEVS MLTNYELSVI NARIRAKHYV YIGDPAQLPA PRVLLSKGTL EPKYFNTVTK
OC43	TDIVVVDEVS MLTNYELSVI NARIRAKHYV YIGDPAQLPA PRVLLSKGTL EPKYFNTVTK
MHV	TDIVVVDEVS MLTNYELSVI NSRVRAKHV YIGDPAQLPA PRVLLNKGTL EPRYFNSVTK
AIPV	CDILLVDEVS MLTNYELSVI NGKINYQYV YVGDPQQLPA PRTLLN-GSL SPKDYNVVTN
SARS CoV	ADIVVFDEIS MATNYDLSV NARIRAKHYV YIGDPAQLPA PRTLLTKGTL EPEYFNSVCR

	1385 1395 1405 1415 1425 1435
EMCR	RMCAIGPDVF LHKCYRCPAE IVNTVSELVY ENKFVPVKPA SKQCFKIFFK G---NVQVDN
229E	RMCAIGPDVF LHKCYRCPAE IVNTVSELVY ENKFVPVKEA SKQCFKIFER G---SVQVDN
PEDV	RMCAIGPDVF LHKCYRCPAE IVRTVSEMVY ENQFIPVHPD SKQCFKIFCK G---NVQVDN
TGEV	RMCTLGPVDF LHKCYRCPAE IVTVSALVY ENKFVPVNP E SKQCFKMFVK G---QVQIES
BoCoV	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNES SSLCFKVYVK G---VTTTHS
OC43	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNES SSLCFKVYVK G---VTTTHS
MHV	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY HNKLKAKNDN SSMCFKVYVK G---QTTTHS
AIPV	LMVCKVPDIF LAKCYRCPKE IVDTVSTLVY DGKFIANNPE SRECFKVIEN NGNSDVGHES
SARS CoV	LMKTIGPDMF LGTCRRCPAE IVDTVSALVY DNKLKAHKDK SAQCFKMFYK G---VITHDV

	1445 1455 1465 1475 1485 1495
EMCR	GSSINRRQLE IVKLFLVKNP SWSKAVFISP YNSQNYVASR FLGLQIQTV D SSQGEYDYV
229E	GSSINRRQLD VVKRFIHKNS TWSKAVFISP YNSQNYVAAR LLGLQTQTV D SAQGEYDYV
PEDV	GSSINRRQLD VVRMFLAKNP RWSKAVFISP YNSQNYVASR LLGLQIQTV D SSQGEYDYV
TGEV	NSSINRRQLE VVKAFLAHNP KWRKAVFISP YNSQNYVARR LLGLQTQTV D SAQGEYDYV
BoCoV	SSAVNMQQIY LINKFLKANP LWHKAVFISP YNSQNFAAKR VLGLQTQTV D SAQGEYDYV
OC43	SSAVNMQQIY LINKFLKANP LWHKAVFISP YNSQNFAAKR VLGLQTQTV D SAQGEYDYV
MHV	SSAVNMQQIY LISKFLKANP SWSNAVFISP YNSQNYVAKR VLGLQTQTV D SAQGEYDFV
AIPV	GSAVNTTQLE FVKDFVCRNK QWREAFIFSP YNAMNQRAYR MLGLNVQTV D SSQGEYDYV
SARS CoV	SSAINRPQIG VVREFLTRNP AWRKAVFISP YNSQNAVASK ILGLPTQTV D SSQGEYDYV

	1505 1515 1525 1535 1545 1555
EMCR	IYAQTSDTAH ACNVNRFNVA ITRAKKGIFC VMCDKT-LFD SLKFFEIKHA --DLHSS---
229E	IFAQTSDTAH ACNANRFNVA ITRAKKGIFC IMSDRT-LFD ALKFFEITMT -DLQSE---
PEDV	IYAQTSDTAH ASNVNRFNVA ITRAKKGILC IMCDRS-LFD LLKFELKLS --DLQAN---
TGEV	IYTQTSDTQH ATNVNRFNVA ITRAKVGILC IMCDRT-MYE NLDFYELKDS KIGLQAKP--
BoCoV	IYSQTAETAH SVNVRNFNVA ITRAKKGILC VMSNMQ-LFE ALQFTTLTVD KVPQAVETRV
OC43	IYSQTAETAH SVNVRNFNVA ITRAKKGILC VMSNMQ-LFE ALQFTTLTLD KVPQAVETKV
MHV	IYSQTAETAH SVNVRNFNVA ITRAKKGILC VMSNMQ-LFE SLNFSTLTLD KIN---NPLR
AIPV	IFCVTADSQH ALNINRFNVA ITRAKRGILV VMQRDELVS ALKFTELDSE TSLQG-----
SARS CoV	IFTQTTETAH SCNVRNFNVA ITRAKIGILC IMSDRD-LYD KLQFTSLEIP RRN-VATLQA

	1565 1575 1585 1595 1605 1615
EMCR	-QVCGLFKNC TRTPLNLPPPT HAHTFLSLSD QFKTTGDLAV QIGSNN--VC TYEHVISFMG
229E	-SSGGLFKDC ARNPIDLPPS HAHTFLSLSD RFKTSGLDVA QIGNNN--VC TYEHVISYMG
PEDV	-EGCGLFKDC SRGDDLLPPS HANTFMSLAD NFKTDQYLAV QIGVNG--PI KYEHVISFMG
TGEV	-ETCGLFKDC SKSEQYIPPA YATTFMSLSD NFKTSDGLAV NIG-TK--DV KYANVISYMG
BoCoV	QCSTNLFKDC SKSYSGYHPA HAPSFVAVDD KYKATGDLAV CLGIGD-SAV TYSRLISLMG
OC43	QCSTNLFKDC SKSYSGYHPA HAPSFVAVDD KYKATGDLAV CLGIGD-SAV TYSRLISLMG
MHV	QCTTNLFKDC SRSYAGYHPA HAPSFVAVDD KYKVGGLDVA CLNVAD-SAV TYSRLISLMG
AIPV	---TGLFKIC NKEFSGVHPA YAVTFLKALAA TYKVNDLAA LVNVEAGSEI TYKHLISLLG
SARS CoV	ENVGTGLFKDC SKIITGLHPT QAPTHLSVDI KFKTEG-LCV DIPGIP-KOM TYRRLISMMG

	1625	1635	1645	1655	1665	1675
EMCR	FRFDISIPGS	HSLFCTRDFA	IRNVRGWLGM	DVESAHVCGD	NIGTNVPLQV	GFSNGVNFVV
229E	FRFDVSMPPGS	HSLFCTRDFA	MRHVRGWLGM	DVEGAHVTDG	NVGTVNPLQV	GFSNGVDFVA
PEDV	FRFDINIPNH	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVVG	NVGTVNPLQL	GFSNGVDFV
TGEV	FRFEANIPGY	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVCGD	NVGTVNPLQL	GFSNGVDFV
BoCoV	FKLDVTLDDGY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFV
OC43	FKLDVTLDDGY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFV
MHV	FKLDLTLDGY	CKLFITRDEA	IRRVRAWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFV
AIPV	FKMSVNVEGC	HNMFITRDEA	IRNVRGWVGF	DVEATHACGT	NIGTNLPFQV	GFSTGADFV
SARS CoV	FKMNYQVNGY	PNMFITREEA	IRHVRWVGF	DVEGCHATRD	AVGTNLPLQL	GFSTGVNLVA

	1685	1695	1705	1715	1725	1735
EMCR	QTEGCVSTNF	GDVVKPVCAR	SPPGQFRHL	VPFLRKQGPW	LIVRRRIVQM	ISDYLNLSD
229E	QPEGCVLTNT	GSVVKPVRAR	APPGQFTHI	VPLLRKQGPW	SVLRKRIVQM	IADFLAGSSD
PEDV	RPEGCVVTES	GDYIKPVRAR	APPGQFQFAHL	LPLLRKQGPW	DVVRKRIVQM	CSDYLANLSD
TGEV	QTEGCVITEK	GNSIEVVKAR	APPGQFQFAHL	IPLMRKQGPW	HIVRRRIVQM	VCDYFDGLSD
BoCoV	EATGLFADRD	GYSFKKAVAK	APPGQFQKHL	IPLMTRGQRW	DVVRPRIVQM	FADHLIDLSD
OC43	EATGLFADRD	GYSFKKAVAK	APPGQFQKHL	IPLMTRGHRW	DVVRPRIVQM	FADHLIDLSD
MHV	EATGMFAERD	GYVFKKAVAR	APPGQFQKHL	VPLMSRGQKW	DVVRIRIVQM	LSDHLVDLSD
AIPV	TPEGLVDTSI	GNNFEPVNSK	APPGQFQFNL	RVLFSKAPW	HVIRPRIVQM	LADNLCNVSD
SARS CoV	VPTGYVDTEN	NTEFTRVNAK	PPPGQFQKHL	IPLMYKGLPW	NVVRIKIVQM	LSDTLKGLSD

	1745	1755	1765	1775	1785	1795
EMCR	ILVFWLWAGS	LELTMMRYFV	KIGPIKICY-	CGNSATCYNS	VSNEYCCFKH	ALGCDYVYNP
229E	VLVFWLWAGG	LELTMMRYFV	KIGAVKHCQ-	CGTVATCYNS	VSNDYCCFKH	ALGCDYVYNP
PEDV	ILIFVLWAGG	LELTMMRYFV	KIGVPSKSCD-	CGKVATCYNS	ALHTYCCFKH	ALGCDYLYNP
TGEV	ILIFVLWAGG	LELTMMRYFV	KIGRPQKCE-	CGKSATCYSS	SQSVYACFKH	ALGCDYLYNP
BoCoV	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	STKRATAYNS	RTGYGWCWRH	SVTCDYLYNP
OC43	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYGWCWRH	SVTCDYLYNP
MHV	SVVLVTWAAS	FELTCLRYFA	KVGKEVVCSV	CNKRATCFNS	RTGYGWCWRH	SYSCDYLYNP
AIPV	CVVFVTWCHG	LELTTLRYFV	KIGKEQVCS-	CGSRATTFNS	HTQAYACWKH	CLGDFEVYNP
SARS CoV	RVVFWLWAHG	FELTSMKYFV	KIGPERTCCL	CDKRATCFST	SSDTYACWNH	SVGFYVYNP

	1805	1815	1825	1835	1845	1855
EMCR	YAFDIQQWGY	VGSLSQNHHT	FCNIHRNEHD	ASGDAVMTRC	LAVHDCFVKR	VDWTVTYPFI
229E	YVIDIQQWGY	VGSLSTNHHA	ICNVHRNEHV	ASGDAIMTRC	LAVYDCFVKR	VDWSITYPMI
PEDV	YCIDIQQWGY	KGSLSLNHHE	ICNVHRNEHV	ASGDAIMTRC	LAIHDCFVKR	VDWSITYPFI
TGEV	YCIDIQQWGY	TGSLSMNHHE	VCNIHRNEHV	ASGDAIMTRC	LAIHDCFVKR	VDWSIVYPFI
BoCoV	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFCNN	INWNVEYPII
OC43	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFCNN	INWNVEYPII
MHV	LIVDIQQWGY	TGSLTSNHDL	ICSVHKGAHV	ASSDAIMTRC	LAVHDCFCCKS	VNWSLEYPII
AIPV	LLVDIQQWGY	SGNLQFNHDL	HCNVHGHAAV	ASVDAIMTRC	LAINNAFCQD	VNWDLTYPHI
SARS CoV	FMIDVQQWGF	TGNLQSNHDQ	HCQVHGNAHV	ASCDAIMTRC	LAVHECFVKR	VDWSVEYPII

	1865	1875	1885	1895	1905	1915
EMCR	ANEKFIINGCG	RNVQGHVVRA	ALKLYKPSVI	HDIGNPKGVR	CA-VTDAKWY	CYDKQPVNSN
229E	ANENAINKGG	RTVQSHIMRA	AIKLYNPKAI	HDIGNPKGIR	CA-VTDAKWY	CYDKNPINSN
PEDV	GNEAVINKSG	RIVQSHIMRS	VLKLYNPKAI	YDIGNPKGIR	CA-VTDAKWY	CFDKNPINSN
TGEV	DNEEKINKAG	RIVQSHVMKA	ALKIFNPAAI	HDVGNPKGIR	CA-TTPIPW	CYDRDPINNN
BoCoV	SNELISINTSC	RVLQRMVLMKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK	FYDAQPIVKS
OC43	SNELISINTSC	RVLQRMVLMKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK	FYDAQPIVKS
MHV	SNEVSINTSC	RVLQRMVLMKA	AMLCNRYDVC	YDIGNPKGLA	CV--KGDFK	FYDASPVVKS
AIPV	ANEDEVNSSC	RYLQRMVLMNA	CVDALKVNVV	YDIGNPKGIK	CVRRGDVNFV	FYDKNPVIRN
SARS CoV	GDELRVNSAC	RKVQHMVVK	ALLADKFPVL	HDIGNPKAIK	CVPPQAEVWK	FYDAQPCSDK

	1925	1935	1945	1955	1965	1975
EMCR	---VKLLDYD	YATHG--QLD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSVF	NLEGVNGGSL
229E	---VKTLEYD	YATHG--QMD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSTL	NLEGVNGGSL
PEDV	---VKTLEYD	YITHG--QFD	GLCLFWNCNV	DMYPEFSVVC	RFDTRCRSPL	NLEGVNGGSL
TGEV	---VRCLDYD	YMVHG--QMN	GLMLFWNCNV	DMYPEFSIVC	RFDTRTRSKL	SLEGVNGGSL
BoCoV	---VKTLLYF	FEAHKDSFKD	GLCMFWNCNV	DKYPPNAVVC	RFDTRVLNNL	NLPGCNGGSL
OC43	---VKTLLYS	FEAHKDSFKD	GLCMFWNCNV	DKYPPNAVVC	RFDTRVLNNL	NLPGCNGGSL
MHV	---VKQFVYK	YEAHKDQFLD	GLCMFWNCNV	DKYPPNAVVC	RFDTRVLNNL	NLPGCNGGSL
AIPV	---VKQFEYD	YNQHKDKFAD	GLCMFWNCNV	DCYPDNLSVC	RYDTRNLSVF	NLPGCNGGSL
SARS CoV	AYKIEELFYS	YATHHDKFTD	GVCLFWNCNV	DRYPANAIVC	RFDTRVLNSL	NLPGCNGGSL

	1985	1995	2005	2015	2025	2035
EMCR	YVNKHAFHTP	AYDKRAVVKL	KPMPPFFYDD	SDCDVQV---	-EQVNYVPLR	ASSCVTRCNI
229E	YVNNHAFHTP	AYDKRAMAKL	KPAPFFFYDD	GSCEVVH---	-DQVNYVPLR	ATNCITKCN
PEDV	YVNNHAFHTP	AFDKRAFAKL	KPMPPFFFYDD	TECDKLQ---	-DSINYVPLR	ASNCITKCN
TGEV	YVNNHAFHTP	AYDRRAFAKL	KPMPPFFFYDD	SNCELVD---	-GQPNYVPLK	SNVCITKCN
BoCoV	YVNKHAFHTK	PFSRAAFEHL	KPMPPFFYSD	TPCVYMDGMD	AKQVDYVPLK	SATCITRCNL
OC43	YVNKHAFHTK	PFARAFAEHL	KPMPPFFYSD	TPCVYMDGMD	AKQVDYVPLK	SATCITRCNL
MHV	YVNKHAFHTS	PFTRAFAFENL	KPMPPFFYSD	TPCVYMEGME	SKQVDYVPLR	SATCITRCNL
AIPV	YVNKHAFYTP	KFDRISFRNL	KAMPFFFYSD	SPCETIQ-V	GVAQDLVSLA	TKDCITKCN
SARS CoV	YVNKHAFHTP	AFDKSAFTNL	KQLPFFFYSD	SPCESHGKQV	VSDIDYVPLK	SATCITRCNL

	2045	2055	2065	2075	2085	2095
EMCR	GGAVCSKHAN	LYQKYVEAYN	TFTQAGFNIW	VPHSFDVYNL	WQIFIET-NL	QSLENIAFNV
229E	GGAVCSKHAN	LYRAYVESYN	IFTQAGFNIW	VPTTFDCYNL	WQTFTEV-NL	QGLENIAFNV
PEDV	GGAVCSKHCA	MYHSYVNAYN	TFTSAGFTIW	VPTSFDTYNL	WQTFEN--NL	QGLENIAFNV
TGEV	GGAVCKKHAH	LYRAYVEDYN	IFMQAGFTIW	CPQNFDTYML	WHGFVNKAL	QSLENVAFNV
BoCoV	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNVVYNL
OC43	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNVVYNL
MHV	GGAVCLKHAE	DYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTR---L	QSLNVVYNL
AIPV	GGAVCKKHAQ	MYAEFVTSYN	AAVTAGFTFW	VTNKLNPYNL	WKSFS---L	QSIDNIAYNM
SARS CoV	GGAVCRHHAN	EYRQYLDAYN	MMISAGFSLW	IYKQFDTYNL	WNTFTR---L	QSLNVAYNV
	2105	2115	2125	2135	2145	2155
EMCR	VKKGCFTGVD	GELPVAVVND	KVFVRYGDVD	NLVFTNKTTL	PTNVAFELFA	KRKMGLTPPL
229E	VNKGFSVGD	GELPVAISGD	KVFVRDGNL	NLVFNKTS	PTNIAFELFA	KRKVGLTPPL
PEDV	LKKGSFVGDE	GELPVAVVND	KVLVRDGTVD	TLVFTNKTS	PTNVAFELFA	KRKVGLTPPI
TGEV	VKKGAFTGLK	GDLPTAVIAD	KIMVRDGTVD	KCIFTNKTS	PTNVAFELFA	KRKLGLTPPL
BoCoV	VKTGHYTGQA	GEMPCAIIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSIRHHPPEL
OC43	VKTGHYTGQA	GEMPCAIIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSVRHHPPEL
MHV	VNAGHFDGRA	GELPCAIVIGE	KVIAKIQNED	VVVFKNNTPF	PTNVAFELFA	KRSIRHHPPEL
AIPV	YKGGHYDAIA	GEMPTVITGD	KAFVIDQGV	KAVFVNQTTL	PTSVAFELFA	KRNIRTLPPN
SARS CoV	VNKGHFDGHA	GEAPVSIINN	AVYTKVDGID	VEIFENKTTL	PVNVAFELWA	KRNIRKVPPEI
	2165	2175	2185	2195	2205	2215
EMCR	SILKNLGVA	TYKFVLWDYE	AERPTSSTYK	SVCKYTDNF-	-----EDV	CVCFDNSIQG
229E	SILKNLGVA	TYKFVLWDYE	AERPLTSFTK	SVCGYTDFA-	-----EDV	CTCYDNSIQG
PEDV	TILRNLGVVC	TSKCVIWDYE	AERPLTFTTK	DVCKYTDFE-	-----GDV	CTLFDNSIVG
TGEV	TILRNLGVVA	TYKFVLWDYE	AERPFSTFTK	QVCSYTDLD-	-----SEV	VTCFDNSIAG
BoCoV	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTDLK-	-----LIDKL	NVLFDRGDRNG
OC43	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTDLK-	-----FIDKL	NVLFDRGDRNG
MHV	KLFRNLNIDV	CWSHVLWDYA	KDSVFCSSTY	KVCKYTDLQ-	-----CIESL	NVLFDRGDRNG
AIPV	RILKGLGVDV	TNGFVIWDYA	NQTPLYRNTV	KVCAYTDIE-	-----FNGL	VVLYDDR-YG
SARS CoV	KILNNLGVDI	AANTVIWDYK	REAPAHVSTI	GVCTMTDIAK	KPTESACSSL	TVLFDGRVGE
	2225	2235	2245	2255	2265	2275
EMCR	SYERTLTNN	AVLFSTVVIK	N-----LTPIK	LNFGMLNGMP	VSSIKSDKGV	EKLWNWYTYV
229E	SYERTLTSTN	AVLFSATAVK	TGGKSLPAIK	LNFGMLNGNA	IATVKSDEGN	IKNINWFYVY
PEDV	SLERFSMTQN	AVLMSLTAVK	K-----LTGIK	LYGYLNGVP	VNTHED----	-KPFTWYIYT
TGEV	SFERFTTTRD	AVLISNNNAVK	G-----LSAIK	LQYGLLNDLP	VSTVGN----	-KPVWYIYV
BoCoV	ALEAFKRSNN	GVYISTTKVK	S-----LSMIR	GPPRAELNGV	VVDKVGDD--	-TDCVFYFAV
OC43	ALEAFKRSNN	GVYISTTKVK	S-----LSMIR	GPPRAELNGV	VVDKVGDD--	-TDCVFYFAV
MHV	ALEAFKRCRD	GVYINTTKIK	S-----LSMIK	GPQRADLNGV	VVEKVGDD--	-SDVEFWFAM
AIPV	DYQSFLLAADN	AVLVSTQCYK	R-----YSYVE	IPSNLLVQNG	MPLKDG----	---ANLYVYK
SARS CoV	QVDLFRNARN	GVLITEGSVK	G-----LTPSK	GPAQASVNGV	TLIGES----	-VKTQFNIFYK
	2285	2295	2305	2315	2325	2335
EMCR	RKNG-----	-----QFQDH	Y-----	-----	-----DGFYTO	GRNLSDFTPR
229E	RKDG-----	-----KPVVDH	Y-----	-----	-----DGFYTO	GRNLQDFLPR
PEDV	RKNG-----	-----KFEDY	P-----	-----	-----DGFYTO	GRTTADFSPR
TGEV	RKNG-----	-----EYVEQ	I-----	-----	-----DSYFTQ	GRTFETFKPR
BoCoV	RKEGQDVIFS	QFDSLGVSSN	QSPQGNLGSN	-EPGNVGGND	ALATSTIFTQ	SRVSSFTCR
OC43	RKEGQDVIFS	QFDSLGVSSN	QSPQGNLGSN	GKPGNVGGND	ALSISTIFTQ	SRVSSFTCR
MHV	RRDGDVIFS	RTGSLEPSHY	RSPQGNPQGN	-RVGDLSGNE	ALARGTIFTQ	SRFLSSFPAP
AIPV	RVNG-----	-----AFVTL	P-----	-----	-----NTINTQ	GRSYETFEPR
SARS CoV	KVDG-----	-----IIQQL	P-----	-----	-----ETYFTQ	SRDLEDFKPR
	2345	2355	2365	2375	2385	2395
EMCR	SDMEYDFLNM	DMGVFINKYG	LEDNFNEHV	YGDVSKTTLG	GLHLISQFR	LSKMGVLKAD
229E	STMEEDFLNM	DIGVFIQYK	LEDNFNEHV	YGDVSKTTLG	GLHLISQVR	LSKMGILKAE
PEDV	SDMEKDFLSM	DMGLFINKYG	LEDYGFHEV	YGDVSKTTLG	GLHLISQVR	LACMGVLKID
TGEV	STMEEDFLSM	DTTLFIQYK	LEDYGFHEV	FGDVSKTTIG	GMHLISQVR	LAKMGLFSVQ
BoCoV	TDMEKDFIAL	DQDVFIQYK	LEDYAFEHIV	YGNFNQKIIG	GLHLILGLYR	RQQTSLNLVQ
OC43	TDMEKDFIAL	DQDVFIQYK	LEDYAFEHIV	YGNFNQKIIG	GLHLILGLYR	RQQTSLNLVQ
MHV	SEMEKDFMDL	DEDVFIKYS	LQDYAFEHIV	YGSFNQKIIG	GLHLILGLAR	RQKSLNLVQ
AIPV	SDIERDFLAM	SEESFVERYG	-KDLGLQHIL	YGEVDKPOLG	GLHTVIGMYR	LLRANKLNK
SARS CoV	SQMETDFLEL	AMDEFTQRYK	LEGYAFEHIV	YGDVSHGQLG	GLHLMIGLAK	RSQDSPLKLE
	2405	2415	2425	2435	2445	2455
EMCR	DFVTSADTTL	RCCTVTYLNE	LSSKVCTYTM	DLLLDFFVTI	LK---SLDLG	VISKVHEVII
229E	EFVAAADITL	KCCTVTYLND	PSSKTVCTYTM	DLLLDFFVSV	LK---SLDLT	VSKVHEVII
PEDV	EFVSSNDSTL	KSCCTVTYADN	PSSKMVCTYTM	DLLLDFFVSI	LK---SLDLN	VSKVHEVMV
TGEV	EFMNSNDSTL	KSCCITYADD	PSSKNVCTYTM	DILLDDFVTI	IK---SLDLN	VSKVVDVIV
BoCoV	EFVS-YDSSI	HSYFITDEKS	GSSKSVCTVI	DILLDDFVAL	VK---SLNLN	CVSKVNVNV
OC43	EFVS-YDSSI	HSYFITDEKS	GSSKSVCTVI	DILLDDFVAL	VK---SLNLN	CVSKVNVNV
MHV	EFVP-YDSSI	HSYFITDENS	GSSKSVCTVI	DLLLDFFVDI	VK---SLNLN	CVSKVNVNV
AIPV	SVTN-SDSDV	MQNYFVLSDN	GSSKQVCTV	DLLLDFFLEL	LRNILEYGT	NKSKVVTVS
SARS CoV	DFIP-MDSTV	KNYFITDAQT	GSSKCVCSVI	DLLLDFFVEI	IK---SQDLS	VISKVVKVTI

	2465	2475	2485	2495	2505	2515
EMCR	DNKPYRWMLW	CKDNHLSTFF	PQLQS-AEWK	CGYAMPQIYK	LQRMCLPCN	LYNYGAGIKL
229E	DNKPYRWMLW	CKDNAVATFF	PQLQS-AEWK	CGYSMPGIYK	TQRMCLPCN	LYNYGAGLKL
PEDV	DCKMWRWMLW	CKDHKLQTFY	PQLQA-SEWK	CGYSMPSIYK	IQRMCLPCN	LYNYGAGVKL
TGEV	DKAWRWMLW	CENSHIKTFY	PQLQS-AEWN	PGYSMPITYK	IQRMCLERCN	LYNYGAQVKL
BoCoV	DFKDFQFMLW	CNDEKVMTFY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS	LWNYGKPVTL
OC43	DFKDFQFMLW	CNDEKVMTFY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS	LWNYGKPVTL
MHV	DFKDFQFMLW	CNEEKVMTFF	PRLQAASDWK	PGYVMPVLYK	YLESPLERN	LWNYGKPVTL
AIPV	DYHSINFMTW	FEDGSIKTCY	PQLQS--AWT	CGYNMPELYK	VQNCVMEPCN	IPNYGVGITL
SARS CoV	DYAEISFMLW	CKDGHVETFF	PKLQASQAWQ	PGVAMPNLYK	MQRMLLEKCD	LQNYGENAVI

	2525	2535	2545	2555	2565	2575
EMCR	PSGIMLNVVK	YTQLCQYLNS	TTCMVPHNMR	VLHYGAGSDK	GVAPGTTVLK	RWLPPD----
229E	PSGIMFNVVK	YTQLCQYFNS	TTLCPVPHNMR	VLHLGAGSDY	GVAPGTAVLK	RWLPHD----
PEDV	PDGIMFNVVK	YTQLCQYLNS	TTCMVPHHMR	VLHLGAGSDK	GVAPGTAVLR	RWLPLD----
TGEV	PDGITTNVVK	YTQLCQYLNT	TTLCPVHKMR	VLHLGAAGAS	GVAPGSTVLR	RWLPPD----
BoCoV	PTGCMNNVAK	YTQLCQYLNT	TTLAVPVNTR	VLHLGAGSEK	GVAPGSAVLR	QWLPAQTILR
OC43	PTGCMNNVAK	YTQLCQYLNT	TTLAVPVNMR	VLHLGAGSEK	GVAPGSAVLR	QWLPAQ----
MHV	PTGCLMNVAK	YTQLCQYLNT	TTLAVPANMR	VLHLGAGSDK	DVAPGSAVLR	QWLPAQ----
AIPV	PSGILMNVAK	YTQLCQYLSK	TTCVPHNMR	VMHFGAGSDK	GVAPGSTVLK	QWLPEG----
SARS CoV	PKGIMMNVAK	YTQLCQYLNT	LTLAVPVNMR	VIHFGAGSDK	GVAPGTAVLR	QWLPTG----

	2585	2595	2605	2615	2625	2635
EMCR	-----AIII	DNDINDYVSD	ADFSITGDCA	TVYLEDKFDL	LISDMYDG--	--RIKFCDGE
229E	-----AIVV	DNDVVDYVSD	ADFSVTGDCA	TVYLEDKFDL	LISDMYDG--	--RTKAIDGE
PEDV	-----AIIV	DNDSVDYVSD	ADYSVTGDSCS	TLYLSDKFDL	VISDMYDG--	--KIKSCDGE
TGEV	-----AILV	DNDLRDYVSD	ADFSVTGDCT	SLYIEDKFDL	LVSPLYDG--	--STKSIDGE
BoCoV	QWLPAQTILV	HNDLYPFVSD	SVATYFGDCI	TLPPDCQWDL	IISDMYD----	---LLLDIGVH
OC43	-----TILV	DNDLYPFVSD	SVATYFGDCI	TLPPDCQWDL	IISDMYD----	---ITKNIGEY
MHV	-----SILV	DNDINPFVSD	SVASYYGNCI	TLPIACQWDL	IISDMYD----	---LTKNIGEY
AIPV	-----TLLV	DNDIVDYVSD	AHVSVLSDCN	KYNTEHKFDL	VISDMYDND	SKRKHEGVIA
SARS CoV	-----TLLV	DSDLNDFVSD	ADSTLIGDCA	TVHTANKWDL	IISDMYD----	---RTKHVTK

	2645	2655	2665	2675	2685	2695
EMCR	NVSKDGFFTY	LNGVIREKLA	IGGSVAIKIT	EYSWNKLYE	LIQRFWFWT	FCTSVNTSSS
229E	NVSKEGFFTY	INGFICEKLA	IGGSIAIKVT	EYSWNKKLYE	LVQRFSFWTM	FCTSVNTSSS
PEDV	NVSKEGFFPY	INGVITEKLA	LGGTVAIKVT	EFSWNKKLYE	LIQKFYFWTM	FCTSVNTSSS
TGEV	NTSKDGFFTY	INGFIKEKLS	LGGSSVAIKIT	EFSWNKOLYE	LIQRFYFWT	FCTSVNTSSS
BoCoV	VVRCS---YI	HCHMIRDKLA	LGGSSVAIKIT	EFSWNAELYK	LMGYFAFWTV	FCTNANASSS
OC43	NVSKDGFFTY	ICHMIRDKLA	LGGSSVAIKIT	EFSWNAELYK	LMGYFAFWTV	FCTNANASSS
MHV	NVSKDGFFTY	LCHLIRDKLA	LGGSSVAIKIT	EFSWNAELYS	LMGKFAFWTI	FCTNANASSS
AIPV	NNGNDVFIY	LSSFLRNNLA	LGGSFVAVKT	ETSWHEVLYD	IAQDCAWWTM	FCTAVNASSS
SARS CoV	NDSKEGFFTY	LCGFIKQKLA	LGGSSIAVKIT	EHSWNADLYK	LMGHFSWWT	FVTNANASSS

	2705	2715	2725	2735	2745	2755
EMCR	EAFILIGINYL	GDFIQGPFIA	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF	ECKHKATVVV
229E	EAFVVGINYL	GDFVAGPFID	GNIHANYVVF	WRNSTVMSLS	YNSVLDLSKF	NCKHKATVVV
PEDV	EAFILIGVHYL	GDFASGAVID	GNTMHANYIF	WRNSTIMTMS	YNSVLDLSKF	NCKHKATVVV
TGEV	EGFLIGINYL	GPYCDKAIVD	GNIMHANYIF	WRNSTIMALS	HNSVLDTPKF	KCRCNNALIV
BoCoV	EGFLIGINYL	GK--PKVEID	GNVMHAIICF	G-----	-----	EIPQFGTGVL
OC43	EGFLIGINYL	GK--PKVEID	GNVMHANYLF	WRNSTVWNGG	AYSLFDMAKF	PLKLAGTAVI
MHV	EGFLIGINYL	NR--TRTEID	GKTMHANYLF	WRNSTVWNGG	AYSLFDMSKF	PLKVAGTAVV
AIPV	EAFILIGNYL	GAS-EKVVS	GKTLHANYIF	WRNCNYLQTS	AYSIFDVAKF	DLRLKATPVV
SARS CoV	EAFILIGNYL	GK--PKEQID	GYTMHANYIF	WRNTNPIQLS	YSYSLFDMSKF	PLKLRGTAVM

	2765	2775	2785	2795		
EMCR	TLKDSVDNDM	VLSLIKSGRL	LLRNSGRFGG	FSNHLVSTK-		
229E	QLKDSIDINEM	VLSLVRSGKL	LVRNGKCLSL	FSNHLVSTK-		
PEDV	NLKDSISIDV	VLGLLKNGKL	LVRNNDALCG	FSNHLVNVNK		
TGEV	NLKEKELNEM	VIGLLRKGKL	LIRNNGKLLN	FGNHVFNTP-		
BoCoV	IACLIWLSNR	LSWLVMF----	-----	-----		
OC43	NLRADQINDM	VYSLLEKGGK	LIRDTNKEVF	VGDSLNVNVI-		
MHV	SLKPDQINDL	VLSLIEKGGK	LVRDTRKEVF	VGDSLNVNVI-		
AIPV	NLKTEQKTDL	VFNLIKCGKL	LVRDVGNTSF	TSDSFVCTM-		
SARS CoV	SLKENQINDM	IYSLLEKGGK	IIRENNRVVV	SSDILVNN--		

d. Putative Orf 1ab

	5	15	25	35	45	55
EMCR	-----	-----M	FYNQVTLAVA	SDSEISGFGF	AIPSVAVRAY	SEAAAQGFQA
229E	-----	-----M	ACNRVTLAVA	SDSEISANGC	STIAQAVRRY	SEAAASNGFRA
PEDV	-----	-----M	ASNHVTLAFA	NDAEISAFGF	CTASEAVSYY	SEAAASGFMQ
TGEV	-----	-----M	SSKQFKILVN	EDYQVNVPSL	PIR-DVLQEI	KYCYRNGFEG
OV43	MSKINKYGLE	LHWAPEFPWM	FEDAEEKLDN	PSSSEVDMIC	STTAQKLETG	GICPENHVMV
BoCoV	MSKINKYGLE	LHWAPEFPWM	FEDAEEKLDN	PSSSEVDIVC	STTAQKLETG	GICPENHVMV
MHV	MAKMGKYGLG	FKWAPEFPWM	LPNASEKLGS	PERSEEDGFC	PSAAQEPKTK	GKTLINHVRV
AIBV	-----	-----	MASSLKQGVV	PKPRDVILVS	KDIPEQLCDA	LFFYTSHNPK
SARS CoV	-----	--MESLVLGV	NEKTHVQLSL	PVLQVRDVLV	RGFGDSVEEA	LSEAREHLKN
	65	75	85	95	105	115
EMCR	CRFVAFGLQD	CVTGINDDDD	VIALTG----	-----	TNQLCAKILL	FSDRPLNLRG
229E	CRFVSLDLQD	CIVGIADDTY	VMGLHG----	-----	NQTLFCNIMK	FSDRPFMLHG
PEDV	CRFVSLDLQD	TVEGLLPEDY	VMVVG----	-----	TTKL SAYVDT	FGRSRPNICG
TGEV	YVFPVEYCRD	LVDCDRKDHV	VIGVLG----	-----	NGVSDLKPVV	LTEPSVMLQG
OV43	DCRRLLKQEC	CVQSSLIREI	VMNASPYDLE	VLLQDALQSR	EAVLVTPLG	MSLEACYVRG
BoCoV	DCRRLLKQEC	CVQSSLIREI	VMNTRPYDLE	VLLQDALQSR	EAVLVTPLG	MSLEACYVRG
MHV	DCSRPLALEC	CVQSAIIRDI	FVDEDEPLNVE	ASTMMALQFG	SAVLVKPSKR	LSIQAWAKLG
AIBV	DYADAFAVRQ	KFDRSLQTGK	QFKFET----	-----V	CGLFLLKGVD	KITPGVPAKV
SARS CoV	GTCGLVELEK	GVLPQLEQPY	VFIKR--SDA	LSTNHGHKVV	ELVAEMDGIQ	YGRSGITLGV
	125	135	145	155	165	175
EMCR	WLIFSNSNYV	LQDFDVVFG-	-HGAGSVVVFV	DKYMCDFDGG	PVLP--KNMW	EFRDYFNDNT
229E	WLIFSNSNYL	LEEFDVVFGK	-RGGGNVTTYT	DQYLCGADGK	PVMS--EDLW	QFVDHFGENE
PEDV	WLLFSNCNYF	LEELELTFG-	-RRGGNIVPVV	DQYMCADGDK	PVLQ--ESEW	EYTDFFADSE
TGEV	FIVRANCNGV	LEDFDLKIA-	-RTGRGAIYV	DQYMCADGDK	PVIE--G---	DFKDYFGDED
OV43	CNPKGWTMGL	FRRRSVCNTG	RCTVKNHVAY	QLYMIDPAGV	CLGAGQFVGV	VIPLAFMPVQ
BoCoV	CNPNGWMTGL	FRRRSVCNTG	RCVANKHVAY	QLYMIDPAGV	CFGAGQFVGV	VIPLAFMPVQ
MHV	VLPKTPAMGL	FKRFCLCNTR	ECVCDAHVAF	QLFTVQPDGV	CLNGRFIGW	FVPVTAIPAY
AIBV	LKATSKLADL	EDIFGVSPLA	RKYRELLKTA	CQWSLTVEAL	DVR-----AQ	TLDEIFDPTE
SARS CoV	LVPHVGETPI	AYRNVLLRK-	--NGNKGAGG	HSYGIDLKSY	DLG--DELGT	DPIEDYEQNW
	185	195	205	215	225	235
EMCR	DS-IVIGGVT	YQLAWDVIRK	DLSYEQQNVL	AIESIHYLG-	TTGHTLKSGC	KLINAKPPKY
229E	E--IIINGHT	YVCAWLTKRK	PLDYKRQNNL	AIEEIEYVHG	DALHTLRNGS	VLEMAKEVKT
PEDV	DGQLNIAGIT	YVKAWIVERS	DVSYAQNLIT	SIKSITYCS-	TYEHTFLDGT	AMKVARTPKI
TGEV	--IIEFEGEE	YHCAWTTVRD	EKPLNQQTLE	TIQEIQYNL-	DIPHKLPNCA	TRHVAPPVKK
OV43	SRKFIVPWVM	YLRKRGEKGA	YNKDHRGGGF	GH-VYDFKVE	DAYDQVHDEP	KGKFSKKAYA
BoCoV	SRKFIVPWVM	YLRKRGEKGA	YIKDYKRGGF	EH-VYNFKVE	DAYDLVHDEP	KGKFSKKAYA
MHV	AKQWLQPWSI	LLRKGGNKGK	VTSGFERRAV	TMPVYDFNVE	DACEEVHLNP	KGKYSRKAYA
AIBV	ILWLQVAAKI	HVSSMAMRRL	VGEVTAKVMD	ALG-----	SNLSALFQIV	KQIARIFQK
SARS CoV	NTKHGSGALR	ELTRELNNGA	VTRYVDNNFC	GPDGYPLDCI	KDFLARAGKS	MCTLS-EQLD
	245	255	265	275	285	295
EMCR	SSKVVLSGEW	NAVYKAFGSP	FITNGISLLD	IIVKPVFFNA	FVKNCNGSEN	WSVGAWDGYL
229E	SSKVVLSDAL	DKLYKVFGSP	VMTNGSNILE	AFTKPVFISA	LVQCTCGTKS	WSVGWDWTFK
PEDV	KKNVVLSEPL	ATIYREIGSP	FVDNGSDARS	IIRRPVFLHA	FVKCKCGSYH	WTVGDWTSYV
TGEV	NSKIVLSELY	KKLYDIFGSP	FMGNGDCLSK	CFDTLHFIAA	TLRCPGSGES	SGVGWDWTFK
OV43	LIRGYRGVVP	LLYVDQYGCD	YTGSGLADGLE	AYADKTLQEM	KALFPTWSQE	LLFDVIVAWH
BoCoV	LIRGYRGVVP	LLYVDQYGCD	YTGSGLADGLE	AYADKTLQEM	KALFPIWSQE	LPFDVTVAWH
MHV	LLKGYRGVKS	ILFLDQYGCD	YTGRLLAKGLE	DYGDCTLEEM	KELFPVWCDS	LDNEVVVAWH
AIBV	ALAI FENVNE	LPQRIAALKM	AFAKCARSIT	VVVVERTLVV	KEFAGTCLAS	INGAVAKFFE
SARS CoV	YIESKRGVYC	CRDHEHEIAW	FTERSDKSYE	HQTPFEIKSA	KKFDTFKGEC	PKFVFLPNKS
	305	315	325	335	345	355
EMCR	SSCCGTPPAK	LCVVPGNVVP	GDVIITSTDA	GCGVKYYAGL	VVKHITNITG	VSLWRVTAVH
229E	SSCCNVISNK	LCVVPGNVKP	GDAVITTTQA	GAGIKYFCGM	TLKFVANIEG	VSVVVRVIALQ
PEDV	STCCGSKCKP	VLVASCASMP	GSAVVVTRAGA	GTGVKYNNM	FLRHVADIDG	LAFWRILKQV
TGEV	TACCGLSGKV	KGVTLGDIKP	GDAVVTMSMA	GKGVKFFANC	VLQYAGDVEG	VSIWKVIKTF
OV43	VVRDPRYVMR	LQSAATIRSV	AYVANPTEDL	CDGSVVIKEP	VHVYADDSII	LRQYNLVDM
BoCoV	VVRDPRYVMR	LQSAATIRSV	AYVANPTEDL	CDGSVVIKEP	VHVYADDSII	LRQYNLVDM
MHV	VDRDPRAVMR	LQTLATIRSI	GYVGQPTEDL	VDGDVVVREP	AHLLAANAIV	KRLPRLVETM
AIBV	ELPNFGMGSK	IFTTLAFFKE	AAVRVVENIP	NAPRGTKGFE	VVGNAKGTQV	VVRGMRNDLT
SARS CoV	VKVIQPRVEK	KKTEGFMGRI	RSVYPVASPQ	ECNNMHLSTL	MKCNHCDEVS	WQTCDFLKAT

	365	375	385	395	405	415
EMCR	SDGMFVATSS	YDALLHRNSL	DPFCFDVNTL	LSNQLRLAFL	GASVTEDVKF	A-----AST
229E	SVDCFVASST	FVEEEHVNRN	DTFCFNVNRN	VTDECRLAML	GAEMTSNVRR	Q-----VAS
PEDV	SKDDLACSGK	FLEHHEEGFT	DPICYFLNDSS	LATKCLKFDIL	SGKFSDEVKQ	A-----IA
TGEV	TVDETCTPG	FEGELN----	DFIKPESKSL	VACSVKRAFI	TGDIDDAVHD	C-----IIT
OV43	SHFYMEADTV	VNAFYGVALK	DCGFVMQFGY	IDCEQDSCDF	KGWIPGNMID	G---FACTTC
BoCoV	SCFYMEADAV	VNAFYGVDLK	DCGFVMQFGY	IDCEQDLCDF	KGWVPGNMID	G---FACTTC
MHV	LYT---DSSV	TEFCYKTKLC	DCGFITQFGY	VDCCGDACDF	RGWVPGNMMD	G---FLCPGC
AIBV	LLDQKADIPV	EPEGWS----	--AILDGHLC	YVFRSGDRFY	AAPLSGNEAL	S-----
SARS CoV	CEHCGTENLV	IEGPTTCGYL	PTNAVVKMPC	PACQDPEIGP	EHSVADYHNH	SNIETRLRKG

	425	435	445	455	465	475
EMCR	GVIDISAGMF	GLYDDILTNN	KPWFVRKASG	LFDAIWDAFV	AAIKLVPTTT	GGLVRFVKSI
229E	GVIDISTGWF	DVYDDIFAES	KPWFVRKAED	IFGPCWSALA	SALKQLKVTT	GELVRFVKSI
PEDV	GHVVVGSALV	DIVDDALG--	QPWFIRKLGD	LASAPWEQLK	AVVRGLGLLS	DEVVLFGRKL
TGEV	GKLDLSNLFL	GNVGLLFKK-	TPWFVQKCGA	LFVDAWKVVE	ELCGSLTLTY	KQIYEVVASL
OV43	GHVYEVGDLI	AQSSGVLPVN	PVLHTKSAAG	YGGFGCKDSF	TLYGQTVVYF	GGCVYWSPAR
BoCoV	GHVYETGDLI	AQSSGVLPVN	PVLHTKSAAG	YGGFGCKDSF	TLYGQTVVYF	GGCVYWSPAR
MHV	SKSYMPELE	AQSSGVIPKG	GVLFQTQSTDT	VN----RESF	KLYGHAVVPF	GSAYVWSPYP
AIBV	-DVHCCERVV	CLSDGVTP--	--EIN--DGL	ILAAIYSSFS	VSELVTALKK	GEFFKFLGHK
SARS CoV	GRTRCFGGCV	FAYVGCYNKR	AYWVPRASAD	IG----SGHT	GITGDNVETL	NEDLLEILSR

	485	495	505	515	525	535
EMCR	ASTVLTVSNG	VIIMCADVPD	AFQPVYRTFT	QAICAAFDfs	LDVFKIG---	-----
229E	CNSAVAVVGG	TIQILASVPE	KFLNAFDVVF	TAIQTVFDCA	VETCTIA---	-----
PEDV	SCATLSIVNG	VFEFLADVPE	KLAAAVTVFV	NFLNEFFESA	CDCLKVG---	-----
TGEV	CTSAFTIVNY	KPTFVVPD-N	RVKDLVDKCV	KVLVKAFDVF	TQIITIAG--	-----
OV43	NWIPIPKSS	VKSYSLSVYT	GVLGCKAIVK	ETNLICKALY	LDYVQHKCGN	LHQRELLGVS
BoCoV	NWIPIPKSS	VKSYSGLVYT	GVVGCKAIVK	ETNLICKALY	LDYVQHKCGN	LHQRELLGVS
MHV	GMWLVPVWSS	VKSADLTFT	GVVGCKAIVQ	ETDAICRSly	MDYVQHKCGN	LEQRAILGLD
AIBV	---FVYAKDA	AVSFTLAKAA	TIADVLRLEFQ	SARVIAEDVW	SSFTEKS---	-----
SARS CoV	---ERVNINI	VGDFHLNEEV	AIILASFSAS	TSAFIDTIKS	LDYKSFKT-I	VESCGNYKVT

	545	555	565	575	585	595
EMCR	---DVKFKR	LGDYVLTEA	LVRLTTEVVR	GVRD-----	-----	A-----
229E	---GKAFDK	VFDYVLLDNA	LVKLVTTLK	GVRE-----	-----	R-----
PEDV	---GKTFNK	VGSYVLFDNA	LVKLVKAKAR	GPRQ-----	-----	A-----
TGEV	---IEAKCFVL	GAKYLLFNNA	LVKLVSVKIL	GKKQ-----	-----	K-----
OV43	DVWHKQLLLN	RGVYKPLEN	IDYFNMRRAK	FSLETFT---	VCADGFMFPL	LDDLVPFRAY
BoCoV	DVWHKQLLLN	RGVYKPLEN	IDYFNMRRAK	FSLETFT---	VCADGFMFPL	LDDLVPFRAY
MHV	DVYHRQLLVN	RGDYSLLLEN	VDLFVKRRAE	FACK-FA---	TCGDGLVPLL	LDGLVPRSYY
AIBV	-----	FEFWKLAYGK	VRNLEEFVKT	YVCK-----	-----	-----
SARS CoV	KGKPVKGAWN	IGQQRSVLTP	LCGFPSQAAG	VIRSIFARTL	DAANHSIPDL	QRAAVTILDG

	605	615	625	635	645	655
EMCR	-RIKKAMFTK	VVVGPTTEVK	FSVIELATVN	LRLVDCAPVV	CPKGKIVVIA	GQAFFYSGGF
229E	-GLNKVKYAT	VVVGSTEEVK	SSRVERSTAV	LTIANNSYKL	FDEGYTVVIG	DVAYFVSDGY
PEDV	-GICEVRYTS	LVVGSTTKVV	SKRVENANVN	LVVVDVETL	NTTGRTVVVD	GLAFFESDGF
TGEV	-GLECAFAFT	SLVGATVNV	PKRTETATIS	LNKVDVVPAP	G-EGYIVIVG	DMAFYKSGEY
OV43	LAVSGQAFCD	YADKLCHAVV	SKSKELLDVS	LDSLGAATHY	LNSKIVDLAQ	HFSDFGTSFV
BoCoV	LAVSGQAFCD	YAGKICHAVV	SKSKELLDVS	VDSLGAATHY	LNSKIVDLAQ	HFSDFGTSFV
MHV	LKSGQAFETS	MMVNFSEHT	DMCQMDALLF	MHDVKVATKY	VKKVTGKLAV	RFKALGVAVV
AIBV	AQMSIVILAA	VLGEDIWHLV	SQVIYKLGVL	FTKVVDVCDK	HWKGFCVQLK	RAKLIVTETF
SARS CoV	ISEQSLRLVD	AMVYTSLLT	NSVIIMAYVT	GGLVQQTQSW	LSNLLGTVE	KLRPIFEWIE

	665	675	685	695	705	715
EMCR	YRFMVDSTTV	LNDPVFTGEL	FYTIKFSFGK	LDGFN-----	---HQFVNAS	SATDAIIAVE
229E	FRLMASPNSV	LTAVYKPLF	AFNVNVMGTR	PE-----	---KFPTTV	TCENLES AVL
PEDV	YRHLADADV	IEHPVYKSAC	ELKPVFECDP	IP--D-----	---FPLPVAA	SVAELCVQTD
TGEV	YFMSSSPNFV	LTNNVFKAVK	VPSYDIVYDV	DNDTKSKMIA	KLGSSFEYDG	DIDAAIVKVN
OV43	SKIVHFFKTF	TTSTALAF AW	VLPHVLHGAY	IVVESDIYFV	KN-IPRYASA	VAQAFQSVAK
BoCoV	SKIVHFFKTF	TTSTALAF AW	VLPHVLHGAY	IVVESDIYFG	KN-IPRYASA	VAQAFRSGAK
MHV	RKITEWFDLA	VDTAASAAGW	LCYQLVNLGF	AVANGGITFL	SD-VPELVKN	FVDKFKVFEK
AIBV	CVLKGVAQHC	FQLLLDAIHS	LYKSFKKCAL	GRIHG-----	---DLLEFWKGG	VHKIVQDGDG
SARS CoV	AKLSAGVEFL	KD-----AWE	ILKFLITGVF	DIVKGQIQVA	SDNIKDCVKC	FIDVVNKALE

	725	735	745	755	765	775
EMCR	LLSDFKTAV	FVYTCVVVDC	SVIVRRDAT-	FATHVCFKDC	YSIWEQFCID	NCGE-----
229E	FVNDKITEFQ	LDYSIDVIDN	EIIVKPNIS-	LCVPLYVRDY	VKDWDFFCRQ	YSNE-----
PEDV	LLLKNYNTPY	KTYSCVVRGD	KCCITCTLQ-	FKAPSYVEDA	VN-FVDLCTK	NIGT-----
TGEV	ELLIEFRQQS	LCFRAFKDDK	SIFVEAYFKK	YKMPACLA KH	IG-LWNIIKK	DSCK-----
OV43	VVLDLSRVTF	IDGLSCFKIG	RRRICLSGRK	IYEVEG-LL	HSSQLPLDVY	DLTMPSQVQK
BoCoV	VGLDLSRVTF	IDGLSCFKIG	RRRICLSGRK	IYEVEG-LL	HSSQLPLDVY	DLTMPSQVQK
MHV	VLIDMSVSV	LSGLTVVKT	SNRVCCLAGCK	VYEVVQK-RL	SAYVMPVGCN	EATC-----
AIBV	IWFDAIDSVD	VEDLGVVQEK	SIDFEVCDV	TLPENQPGHM	VQIEDDGKNY	MFFR-----
SARS CoV	MCIDQVTIAG	AK-LRSLNLG	EVFIAQSKGL	YRQCIRGKEQ	LQLLMPLKAP	KEVT-----

	785	795	805	815	825	835
EMCR	-----PW	FLTDYNAILQ	SNNPQCAIVQ	ASESK-----	--VLLERFLP	KCPEILLSID
229E	-----SW	FEDDYRAFIS	VLDITDAAVK	AAESK-----	--AFVDITVP	PCPSILKVID
PEDV	-----AG	FHEFYITAHE	QODLQGFLLT	CCTMSG-----	F-ECFMPTIP	QCPAVLEEID
TGEV	-----RG	FLNLFNHLNE	LEDIKETNIQ	AIKN-----	-----I-	LCPDPLLDLD
OV43	AKQKPIYLKG	SGSDFSLADS	VVEVVTSLT	PCG-----YS	EPPKVADKIC	IVDNVYMAKA
BoCoV	TKQKGIYLKG	SGSDFSLADS	VVEVVTSLT	PCG-----YS	EPPKVADKIC	IVDNVYMAKA
MHV	-----LVG	EIEPAVVEDD	VVDVVKAPLT	YQG-----CC	KPPTSFEKIC	VVDKLYMAK
AIBV	-----FKK	DENIYYTPMS	QLGAINVVCK	AGG-----	-----KTVT	FGETTVQEIP
SARS CoV	-----FLEG	DSHDTVLTSE	EVVLKNGELE	ALETVPDSFT	NGAIVGTPVC	VNGLMLEIK

	845	855	865	875	885	895
EMCR	DGHLWNLFVE	K-----	-FNFVTDWLK	TLKLTLSNG	LLGNCARFR	RVLVKLLDVY
229E	GGKIWNQVIK	N-----	-VNSVRDWLK	SLKLNLTQQG	LLGTCAKRFK	RWLGLLEAY
PEDV	GGSIWRSFIT	G-----	-LNTMDFCK	RLKVSFGLDG	IVVTVARKFK	RLGALLAEMY
TGEV	YGAIWYNCMP	G-----	-CSDP-SVLG	SVQLLIGNG-	-VKVVCDCGCK	GFANQLSKGY
OV43	GDKYYPVVVD	-DHVGLLDQA	WRVPCAG--R	RVTFKQPTV	KEIISMPKII	KVFEYLDNDF
BoCoV	GDKYYPVVVD	-GHVGLLDQA	WRVPCAG--R	CVTFKEQPTV	NEIASTPKTI	KVFEYLDKDF
MHV	GDKYYPVVVD	NDTIGVLDQC	WRFPACAG--K	KVEFNDKPKV	KEIPST-RKI	KINFALDATF
AIBV	PPDVVPIKVS	-----	--IECCG--E	PWNTIFKKAY	KEPIEVDTDL	TVEQLLSVIY
SARS CoV	DKEQYCALSP	--GLLATNNV	FRLKGGAPIK	GVTFG-EDTV	WEVQGY-KNV	RITFELDERV

	905	915	925	935	945	955
EMCR	NGFLETVCVS	VHTAGVCIKY	YAVNVV-YVV	ISGFVSRVIR	RERCD--VTF	PCVSCVTFYF
229E	NAFLDTVVST	VKIGGLTFKT	YAFDKP-YIV	IRDIVCKVEN	KTEAEWIELF	PHNDRKSFSS
PEDV	NTYLSTVVEN	LVLGVSFKY	YATSVV-KIV	LGGCFHVSVK	VFASV--FQI	PVQAGIEKFK
TGEV	NKLCNAARND	IEIGGIPFST	FKTPTNTFIE	MTDAIYSVIE	QGKALS----	-----
OV43	NTILNTACGV	FEVDDTVDM	EFYAVVIDAI	EEKLSPCKEL	EGVGAKVSAF	LQKLEDNPLF
BoCoV	NTILNTACGE	FEVDDTVDM	EFYAVVIDAI	EEKLSPCKEL	EGVGAKVSAF	LQKLEDNSLF
MHV	DSVLSKACSE	FEVDKDVTL	ELLDVVLDAV	ESTLSPCKEH	DVIGTKVCAL	LNRLAEDVYV
AIBV	EKMCDLKLK	PEAPEPPFFE	NVALVDKNGK	DLDCIKSCHL	IYR-----	-----
SARS CoV	DKVLNEKCSV	YTVESGTEVT	EFACVVAEAV	VKTLPVSDL	LTN---MGID	LDEWSVATFY

	965	975	985	995	1005	1015
EMCR	EFLDTCFGVS	K----PNAID	VEHLELKETV	FVEPKDGGQF	FVSDDYLWYV	V-DDIYYPAS
229E	TFESAYMPIA	D----PTHFD	IEEVELLDAE	FVEPGCGGIL	AVIDEHVYFK	K-DGVYYPNS
PEDV	VFLNCVHPVV	-----PRVIE	TSFVELEETT	FKPPALNGGI	AIVDGFAFY	D-GTLYYPTD
TGEV	-FRDADVPPV	DNGTISTADW	SEPILEPAE	YVKPKNNGNV	IVIAGYTFYK	DEDEHFYPYG
OV43	LFDEAGEEVL	APKLYCAFTA	P--EDDDFLE	ESDVEEDDVE	GEETDLTVTS	AGQPCVASEQ
BoCoV	LFDEAGEEVL	APKLYCAFTA	P--EDDDFLE	ESGVEEDDVE	GEETDLTVTS	AGEPCVASEQ
MHV	LFDEEGEEVI	APKMYCSFSA	P--DDEDCVA	ADVVDADENQ	GDDADDSAAAL	VTDTQEEDGV
AIBV	-DYESDDIE	E-----ED-	AECECTDSGE	AECECTDNSEC	EEDEEDTKVL	ALIQDPASIK
SARS CoV	LFDDAGEENF	SSRMVCSFYP	PDEEEEDDAE	CEEEIEDETC	EHEYGTEDDY	QGLPLEFGAS

	1025	1035	1045	1055	1065	1075
EMCR	CNGVLPAVFT	KLGGK--IS	FSDDVIVHDV	EPTHKVKLIF	EFE-----	-----DDVVT
229E	GTNLPVAVFT	KAAGGK--VS	FSDDVEVKDI	EPVYRVKLCF	EFE-----	-----DEKLV
PEDV	GNSVVPICFK	KKGGGD--VK	FSDEVSVKTI	DPVYKVSLEF	EFE-----	-----SETIM
TGEV	FGKIVQRMYN	KMGGGDKTVS	FSEEDVQEI	APVTRVKLEF	EFD-----	-----NEIVT
OV43	EESSEVLEDT	LDDGSPSVETS	DSQVEEDVEM	SDFVLESVI	QD-----	-----YENVCF
BoCoV	EESSEVLEDT	LDDGPCVETS	DSQVEEDVQM	SDFGDESVI	QD-----	-----YENVCF
MHV	AKGQGVVAES	DARLDQVEAF	DIEKVEDPIL	NELSAELNAP	ADKTYEDVLA	FDIAIYSEALS
AIBV	YPLPLDEDYS	VYNGCIVHKD	ALDVNLPSPG	EETEVVNNCF	EG-----	-----AVK
SARS CoV	AETVRVEEEE	EEDWLDDTTE	QSEIEPEPEP	TPEEPVNQFT	GYLK-----	-----LTDNVAI

	1085	1095	1105	1115	1125	1135
EMCR	SLCKK-----	-----S	FGKSIITYTG-	DWEGLEHEVLT	SAMNVIG---	--QHIKLPQF
229E	DVCEK-----	-----A	IGKKIKHEG-	DWDSFCKTIQ	SALSVVS---	--CYVNLPTY
PEDV	AVLNK-----	-----A	VGNRIKVTG-	GWDDVVEYIN	VAIEVLK---	--DHVEVPKY
TGEV	GVLER-----	-----A	IGTRYKFTGT	TWEEFEESIS	EELDAIFDTL	ANQGVLELEGY
OV43	EFYTT--EPE	FVKVLGLYVP	K--ATRNNCW	LRSLAVMQK	LPCQFKDKNL	QDLWLVLKQKQ
BoCoV	EFYTT--EPE	FVKVLGLYVP	K--ATRNNCW	LRSLAVMQK	LPCQFKDKNL	QDLWLVLKQKQ
MHV	AFYAVPGDET	HFKVCGFYSP	A--IERTNCW	LRSTLIVMQS	LPLEFKDLEM	QKLWLVSYSKS
AIBV	PLPQK-----	-----	----VVDVLG	DWGEAVDAQE	QLCQEP---	----LQHTFE
SARS CoV	KCVDIVKEAQ	SANPMVIVNA	ANIHLKHGGG	VAGALNKATN	GAMQKESDDY	IKLNGPLTVG

	1145	1155	1165	1175	1185	1195
EMCR	YIYDEGGYD	VSKP--VMIS	QWPISSDDSDG	CVVEASTDFH	Q--LESVREE	VD-----
229E	YIYDEGGND	LSLP--VMIS	EWPLSVQQAQ	QEATLPDIAE	D--VVDQVEE	VNS-----
PEDV	YIYDEGGTD	PNLP--VMVS	QWPLNDTIS	QDLLDVEVVT	DAPIDSEGDE	VDSSAPEKVA
TGEV	FIYDTCGGFD	IKNPDGIMIS	QYDINITADE	KSEVSASSE	EE-VESVEED	PENEIVEASE
OV43	YSOLFVDTLV	NKIPANIVLP	QGGYVADFAY	WFLTLCDWQC	VAYWKCIKCD	LALK---LKG
BoCoV	YSOLFVDTLV	NKIPANIVLP	QGGYVADFAY	WFLTLCDWQC	VAYWKCIKCD	LALK---LKG
MHV	YNKEFVDKLV	KSVPKSIILP	QGGYVADFAY	FFLSQCSFKA	YANWRCLKCD	MDLK---LQG
AIBV	EPVENSTGSS	KTMTQVQVVE	QDELVPVEQD	QDVVYVPTPD	LEVAKETAEE	VD-----
SARS CoV	GSCLLSGHNL	AKKCLHVVGP	NLNAGEDIQL	LKAAYENFNS	QDILLAPLLS	AGIFG--AKP

	1205	1215	1225	1235	1245	1255
EMCR	-----	-----	-----IIE	QPFGEVEHAL	SIRQ-----	---PFSFSFR
229E	-----	-----	-----IFD	IETVDVKHDV	S-----	---PFEMPFE
PEDV	-----D	VANSEPGDDG	LPVAPETNVE	SEVEEVAATL	SFIKDTPTSTV	TKDPFAFDFV
TGEV	GAEGTSSQEE	VETVEVADIT	STEEDVDIVE	VSAKDDPWAA	AVDVQEAQEF	NPSLPPFKTT
OV43	LDAMFFYGDV	VSHICKCGES	MVLIDVDVPF	TAHFALKDKL	FCAFITKRIV	YKAACVVDVN
BoCoV	LDAMFFYGDV	VSHVCKCGES	MVLIDVDVPF	TAHFALKDKL	FCAFITKRSV	YKAACVVDVN
MHV	LDAMFFYGDV	VSHVCKCGTG	MTLLSADIPY	TLHFGLRDDK	FCAFYTPRKV	FRAACVVDVN
AIBV	-----	-----	-----EFIL	IFAVPKEEVV	S-----	QKDGGA
SARS CoV	LQSLQVCVQT	VRTQVYIAVN	DKALYEQVVM	DYLDNLKPRV	EAPKQEEPPN	TEDSKTEEKS

	1265	1275	1285	1295	1305	1315
EMCR	DELGVRVLDQ	SDNNCWISTT	LIQLQLTKLL	DDSIEMQLFK	VGKVDISIVQK	CYELSHLISG
229E	ELNGLKILKQ	LDNNCWVNSV	MLQILQTLGIL	DGDYAMQFFK	MGRVAKMIER	CYTAEQCIRG
PEDV	SYGGKVLRLQ	SHNNCWVTST	LVQLQLLGIV	D-DPAMELFS	AGRVGPMVRK	CYESQKAILG
TGEV	NLNGKIILKQ	GDNNCWINAC	CYQLQAFDFF	N-NEAWEKFK	KGDVMDVFNL	CYAATTLARG
OV43	DSHMAVVDG	KQIDDHRTS	ITSDKFDFFI	G-HGMSFSMT	TFEIAQLYGS	CITP-NVCFV
BoCoV	DSHMAVVDG	KQIDDHRTS	ITSDKFDFFI	G-HGTSFSMT	TFEIAQLYGS	CITP-NVCFV
MHV	DCHMAVVDG	KQIDGKVVTK	FNGDKYDFMV	G-HGMAFSMS	AFEIAQLYGS	CITP-NVCFV
AIBV	QIKQEPQVQV	KPQREKKAKK	FKVKPATCEK	P-----K-	FLEYKTCVGD	LTVVIAKALD
SARS CoV	VVQRPVDVKP	KIKACIDEVT	TTLEETKFLT	N-KLLLFADI	NGKLYHDSQN	MLRGEDMSFL

	1325	1335	1345	1355	1365	1375
EMCR	SLGDSGKLLS	ELLKDKYTCS	ITFEMSCDCG	KKFDEQVGC	FWIMPYTKLF	QKGECCICHK
229E	AMGDVGLCMY	RLKDLHTGTF	MVMDDYKCSCT	SGRLEESGAV	LFCTPTTKAF	PYGTCLNCNA
PEDV	SLGDVSACLE	SLTKDLHTLK	ITCSVVCGCG	TGERIYEGCA	FRMTPTLEPF	PYGACAQCAQ
TGEV	HSGDAEYLL	LMLNDYSTAK	IVLAACKCGC	EKEIVLERAV	FKLTPLESF	NYGVCDCMQ
OV43	KGDIKVSCL	VKAEEVVNPA	NGHMAHGGGV	AKAIAVAAGQ	QFVKETDMV	KSKGVCATGD
BoCoV	KGDIKVSCL	VKAEEVVNPA	NGHMAHGGGV	AKAIAVAAGQ	QFVKETDMV	KSKGVCATGD
MHV	KGDVIKVLRR	VGAEEVVNPA	NGRMAHAGAV	AGAIKAAGK	SFIKETADMV	KNQGVCCQVGE
AIBV	EFKEFCIVNA	ANEHMTGSG	VAKAIADFCG	LDFVEYCEDY	VKKHGPQQR	VTPSFVKGIQ
SARS CoV	EKDAPYMGVD	VITSGDITCV	VIPSKRAGGT	TEMLSRALKK	VPVDEYITTY	PGQGCAGYTL

	1385	1395	1405	1415	1425	1435
EMCR	MQTYKLVSML	GTGVFVQD--	PAPIDIDAF	VRPICSSVYL	GVKGSBGHYQT	NLYSFDKAID
229E	PRMCTIRQLQ	GTIIIFVQKQ-	PEPVNPVSFV	VKPVCSIFR	GAVSCGHYQT	NIYSQNLCDV
PEDV	VLMHTFKSIV	GTGIFCRD--	TTALSLSL	VKPLCAAFFI	GK-DSGHYVT	NFYDAAMAID
TGEV	VNTCRFLSVE	GSQVFVHDIL	SKQTPEAMFV	VKPMHMAVYT	GTTQNGHYMV	DDIEHGYCVD
OV43	CYVSTGGKLC	KTVLNVVGP	ARTQKGQSYV	LLERVYKHLN	NYDCVVTTLI	SAGIFSVPD
BoCoV	CYVSTGGKLC	KTVLNVVGP	ARTQKGQSYA	LLERVYKHLN	KYDCVVTTLI	SAGIFSVPD
MHV	CYESTGGNLC	KTVLNVVGP	ARGHKGQCY	FLERAYQHIN	KCDDVVTTLI	SAGIFSVPD
AIBV	CVNNVVGPRH	GDNNLHEKLV	AAYKNVLVDG	VVNYVVPVLS	LGIFGVDFKM	SIDAMREAFE
SARS CoV	EEAKTALKKC	KSAFYVLPSE	APNAKEEILG	TVSWNLREML	AHAETRKLK	PICMDVRAIM

	1445	1455	1465	1475	1485	1495
EMCR	GFGVFDIK--	-----	-----NSSV	NTVCFVDVDF	HS-VEIEAGE	VK-----
229E	GFGVNIQIP-	-----	-----WTNDAL	NTICIKDADY	NAKVEISVTP	IKNTVDTTPK
PEDV	GYGRHQIK--	-----	-----YDTL	NTICVKDWNW	TAPLVPAVDS	VVEP-----
TGEV	GMGIKPLKKR	CYTSTLFINA	NVMTRAEPK	QEFKVEKVEQ	QPIVEENKSS	IEKEEIQSPK
OV43	VSLTYLLGTA	KKQVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
BoCoV	VSLTYLLGTA	KKQVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
MHV	VSLTYLLGTA	KKQVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
AIBV	GCTIRVLLFS	TKNVILVSNN	KDDFDVIEK	QVTSIAG-TK	ALSLOLAKNL	CRDVKFETNA
SARS CoV	ATIQRKYKGI	KIQEGIVDYG	VRFFFYTSKE	PVASIITKLN	SLNEPLVTMP	IGYVTHGFNL

	1505	1515	1525	1535	1545	1555
EMCR	EEFVVKELN	PFAVYKNVVF	YLGDISHLVN	CVSDFDFVNA	ANENLMHGGG	VARAIDILTE
229E	EEFVVKELN	AFVLVDNVAF	YQGDVPTVVN	GVDFDFIVNA	ANENLAHGGG	LAKALDVYTK
PEDV	-----VVK	PFYSYKNVDF	YQGDVPTVVN	-LPCDFVNA	ANEKLSHGGG	IAKAIDVYTK
TGEV	ND-----DLIL	PFYKAGKLSF	YQGDVPTVVN	FLEPDVIVNA	ANGDLKHMGG	VARAIDVFTG
OV43	NKLILN---	DVAFVSTFNV	LQDVLVSLRHD	IALDDDARTF	VQSNVDVVP	GWRVNVKIFYQ
BoCoV	NKLILN---	DVAFVSTFNV	LQDVLVSLRHD	IALDDDARTF	VQSNVDVVP	GWRVNVKIFYQ
MHV	CDSLFS----	DSCFVSSYDV	LQEVLLRHD	IQLDDDDARV	VQAHMDNLPA	DWRLVNFDS
AIBV	-----	-----	-----SIVLKP	DSLQFGQVY	AKNKIVFTAD	DVEDKEILYV
SARS CoV	EEAARCMR--	SLKAPAVVSV	SSPDVATTYN	GYLTSSSKTS	EEHFVETVSL	AGSYRDWSYS

	1565	1575	1585	1595	1605	1615
EMCR	GQLQSLSKDY	ISSNGPLKVG	AGVMLE--CE	KFN--VFNVV	GPRTG----	KHEHSLLVEA
229E	GKLQRLSKEH	IGLAGKVKVG	TGVMVE--CD	SLR--IFNVV	GPRKG----	KHERDLLIKA
PEDV	GMLQKCSNDY	IKAHGPIKVG	RGVMLE--AL	GLK--VFNVV	GPRKG----	KHAPELLVKA
TGEV	GKLTERSNDY	LKKNKSIAPG	NAVFFENVIE	HLS--VLNAV	GPRNGD----	SRVEAKLCNV
OV43	INGVRT-VKY	FECTGGIDIC	QGGKFGYVQ	QGIFNKATVA	QIKALF----	LDKVDILLTV
BoCoV	INGVRT-VKY	FECPGGIDIC	SQDKVFGYVQ	QGSFNKATVA	QIKALF----	LDKVDILLTV
MHV	VDGVRT-VKY	FECPEGIFVS	SQGGKFGYVQ	NGSFKVASVS	QIRALL----	ANKVDVLCVT
AIBV	PTTDKSLILEY	YGLDAQKYVI	YQTLAQKWN	VQYRDNLFLI	EWDRGN--CW	ISSAVILLQA
SARS CoV	GQRTGELGVEF	LKRGDKIVYH	TLESPEVEFHL	DG--EVLSD	KLKSLSLRE	VKTIVVFETT

	1625	1635	1645	1655	1665	1675
EMCR	YNSILFENGI	PLMPLLSGCI	FGVRIENSLK	ALFSCDINKP	LQVFVYSSNE	EQAVLKFLDG
229E	YNTINNEQGT	PLTPILSCGI	FGIKLETSLE	VLLDVCNTKE	VKVVFYTDTE	VCKVKDFVSG
PEDV	YKSVFANSGV	ALTPLISVGI	FSVPLEESLS	AFLACVGDHR	CKCFYGDKE	REAIKYMMDG
TGEV	YKAIACEGK	ILTPILSVGI	FNVRLETSLO	CLLKTVDNRG	LNVFVYTDQE	RQTIEFFS-
OV43	DGVNFTNRFV	PVGESFGKSL	GNVFCDGVNV	TKHKCDINYK	GKVFQFDNL	SSEDLKAVRS
BoCoV	DGVNFTNRFV	PVGESFGKSL	GNVFCDGVNV	TKHKCDINYK	GKVFQFDNL	SSEDLKAVRS
MHV	DGVNFRSCCV	AEGEVFGKTL	GSVFCDGINV	TKVRCSAIHK	GKVFQYSGL	SAADLVAVTD
AIBV	AKIRFKGFLT	EAWAKLLGGD	PTDFVWCYA	SCTAKVGDFS	DANWLLANLA	EHFDADYTNA
SARS CoV	DNTNLHTQLV	DMSMTYQQQF	GPTYLDGADV	TKIKPHVNHE	GKTFFVLPSD	DTLRSEAFEY

	1685	1695	1705	1715	1725	1735
EMCR	LDLTPVID--	-----DVDV	V-----	--KPFREVEG	FSFFDCG---	VNALDGD-IY
229E	LNVNPKVE--	-----QPKI	EPKPVSVIKV	APKPYRVGDK	FSYFTED---	LLCVADDKPI
PEDV	LVDAIFKEAL	VDTPPVQEDV	QQVSQKPVLP	NFEPFRIEGA	HAFYECNPEG	LMSLGAD-KL
TGEV	-----	-----	-----	-----	-----	-----
OV43	SNFNDQKELL	AYYNMLVN--	CFKWQVVVNG	KYFTFKQANN	NCFVNVSCLM	LQSLHLTFKI
BoCoV	SNFNDQKELL	AYYNMLVN--	CSKWQVVFNG	KYFTFKQANN	NCFVNVSCLM	LQSLNLKFKI
MHV	AFGFDEPQLL	KYYNMLG---	MCKWPVVVCG	NYFAFKQSNN	NCYINVACL	LQHLSLKFHK
AIBV	FLKKRVSCN-	-----	-----	-----	-----	-----
SARS CoV	YHTLDESFLG	RYMSALNH--	TKKWKFQVVG	GLTSIKWADN	NCYLSSVLLA	LQOLEVKFNA

	1745	1755	1765	1775	1785	1795
EMCR	LLFTNSILML	DKQGQL----	LDTKLNGILQ	QAVLDYLATV	KTVPAAGNLVK	LVVE-SCTIY
229E	VLFTDSMLTL	DDRGLA----	LDNALSGVLS	AAIKDCVDIN	KAIPSGNLIK	FDIG-SVVVY
PEDV	VLFTNSNLDF	CSVGK-----	LNDVTSGALL	EAINVFKKSN	KTVPAAGNCVT	LDCANMISIT
TGEV	-----	-----	-----	-----	-----	-----
OV43	VQWQEAWLEF	RSGRPAREFVA	LVLAKGGFKF	GDPADSRDFL	RVVFSQVDLT	GAICDFEAC
BoCoV	VQWQEAWLEF	RSGRPAREFVS	LVLAKGGFKF	GDPADSRDFL	RVVFSQVDLT	GAICDFEAC
MHV	VQWQEAWNEF	RSGKPLRFVS	LVLAKGSFKF	NEPSDSTDFM	RVVLREADLS	GATCDFEFVC
AIBV	-----	-----	-----	-----	-----	-----
SARS CoV	PALQEAYYRA	RAGDAANFCA	LILAYSNKTV	GELGDVRETM	THLLQHANLE	SAKRVLNVVC

	1805	1815	1825	1835	1845	1855
EMCR	M-CVVPISND	LSFDKNLGRG	VRKLNRLKTC	VIANVPAIDV	LKKLLSSLTL	TVKFVVESNV
229E	M-CVVPSEKD	KHLDDNNVQR	TRKLNRLMCD	IVCTIPADYI	LPLVLSSLTC	NVSFVGEKLA
PEDV	M-VVLPFDGD	ANYDKNYARA	VVKVSKLKGK	LVLAVDDATL	YSKLS--HLS	VLGFVSTPDD
TGEV	--CSIP----	-----	-----	-----	-----	-----
OV43	K-CGVKQEQR	TGLDAVMHFG	TLSREDLEIG	YTVDCSCG--	--KKLIHCVRF	DVPFLICSNT
BoCoV	K-CGVKQEQR	TGLDAVMHFG	TLSREDLEIG	YTVDCSCG--	--KKLIHCVRF	DVPFLICSNT
MHV	K-CGVKQEQR	KGVDAMHFG	TLDKGDLAKG	YTIACGCG--	--NKLHVHCTQL	NVPFLICSNT
AIBV	--CGIKSYEL	RGLEACIQP-	-----	-----	-----	-----
SARS CoV	KHCGQKTTTL	TGVEAVMYMG	TLSYDNLKGT	VSIPVCVGR-	-DATQYLVQQ	ESSFVMSAP

	1865	1875	1885	1895	1905	1915
EMCR	MDVNDCKFND	NVVLKITEDG	INVKDVVSES	SKSLGKQLG-	VVSDGVDSFE	GVLV--INTD
229E	AEA-----K	VITIKVTEDE	VNVHDVTVT	DKSFEQQVVG	VIADKDKDLS	GAVPSDLNLS
PEDV	VER--FYANK	SVVIKVTEDT	RSVKAVKVES	TATYGGQIG-	PCLVNDTVVT	DNKP--VVAD
TGEV	--VN-----	-----VTEDN	VNHERVSVSF	DKTYGEQLKG	TVVIKDKDVT	NQLPSAFDVG
OV43	PASVKLPKG-	VGSANIFIG-	DKVGHYVHVK	CEQSYQLYDA	SNVKKVTDVT	GKLSDCLYLK
BoCoV	PASVKLPKG-	VGSANIFIG-	DKVGHYVHVK	CEQSYQLYDA	SNVKKVTDVT	GKLSDCLYLK
MHV	PEGKKLPDD-	VVAANIFTG-	GSLGHYTHVK	CKPKYQLYDA	CNVSKVSEAK	GNFTDCLYLK
AIBV	-----LLHF	TQYSNCPCTG	ANNTDVEIEA	SLPYLLLFAT	DGPATVDCDE	DAVG-----
SARS CoV	PAEYKLQGGT	FLCANEYTG	YQCGHYTHIT	AKETLYRIDG	AHLTKMSEYK	GPVTDVFIY-K

	1925	1935	1945	1955	1965	1975
EMCR	TVLSVAPEVD	WVAFYGFKA	ALFASLDVVP	YGYPNDFVGG	FRVLGTTDNN	CWVNATCIIL
229E	ELLTKAIDVD	WVEFYGFKA	VTFATVDHSA	FAYESAVVNG	IRVLKTSDDN	CWVNAVCIAL
PEDV	VVAKVVPNAN	WDSHYGFKA	GEFHMLDHTG	FTFPSEVVNG	RRVIKTTDNN	CWVNVTCLOL
TGEV	QKVIKAIDID	WQAHYGFRA	AAFSASSHDA	YKFEVVTSHN	FIVHKQTDNN	CWVNAVCIAL
OV43	NLKQTFKSVL	TTYLLDDVKK	IEYKPDLSQY	YCDGGKYYTQ	RIIKAQFKTF	EKVVDGVTNF
BoCoV	NLKQTFKSVL	TTYLLDDVKK	IEYKPDLSQY	YCDGGKYYTQ	RIIKAQFKTF	EKVVDGVTNF
MHV	NLKQTFSSKL	TTYLLDDVKK	VEYNPDLSQY	YCESGKYYTK	PIIKAQFRTF	EKVVDGVTNF
AIBV	TVVFGSTNS	GHCYTQAAG	AFDNLAKDRK	FGKKSPIYTA	MYTRFAFKNE	TSLPVAKQSK
SARS CoV	ETSYTTTIKP	VSFKLDGVTY	TEIEPKLDGY	YKKNAYYTE	QPIDLVP-TQ	PLPNASFDNF

	1985	1995	2005	2015	2025	2035
EMCR	QYLKPTFKSK	GLNVLWKNFV	TGDVGPFVSV	IYFITMSSKG	QKGDAAEALS	KLSEYLSIDS
229E	QYSKPHFISQ	GLDAAWNKFV	LGDDVIFVAF	VYYVARLMKG	DKGDAEDTLT	KLKSLANEA
PEDV	QFARFRFKSA	GLQAMWESYC	TGDVAMFVHW	LYWLTGVODK	QPSDSENALN	MLSKYIVPAG
TGEV	QRLKPQWKFP	GVRGLWNEFL	ERKTQGFVHM	LYHISGVKKG	EPGDAELMLH	KLGLDMDNDC
OV43	KLIG--HTVC	DSLNAKLGFD	SSKEFVEYKI	TEWPTATGDV	VLATDDLYVK	RYERGCIITFG
BoCoV	KLIG--HTVC	DILNAKLGFD	SSKEFVEYKV	TEWPTATGDV	VLATDDLYVK	RYERGCIITFG
MHV	KLVG--HSIA	EKFNAKLGFD	CNSPFTEYKI	TEWPTATGDV	VLASDDLYVS	RYSGGCVTFG
AIBV	GKSG--VKED	VSNLATSSKA	SFDNLATFEQ	WYDSNIYESL	KVQESPDNFD	KYVSFTTKED
SARS CoV	KLTCSTNKFA	DDLNQMTGFT	KP-ASRELSV	TFFPDNLGVD	VAIDYRHISA	SFKKGAKLLH

	.....|.....| 2045	.....|.....| 2055	.....|.....| 2065	.....|.....| 2075	.....|.....| 2085	.....|.....| 2095
EMCR	IVTLEQYSTC	DIC-----	-----KSTVV	EVKSAVVCAS	VLKDGCDVG-	-----
229E	QVQLEHYSSC	VECDAKF---	-----KNSVA	SINSAIVCAS	VKRQGVQVG-	-----
PEDV	SVTIERVTHD	GCC-----	-----CSKR	VVTAPVNNAS	VLKLGVEDG-	-----
TGEV	EIIIVTHTTAC	DKC-----	-----AKVE	KFVGPVVAAP	LAIHGTDE--	-----
OV43	KPVIWLSHEK	ASLNSLT---	-----YFNRP	SLVDDNKFDV	LKVDDVD---	-----
BoCoV	KPVIWLSHEQ	ASLNSLT---	-----YFNRP	LLVDENKFDV	LKVDDVD---	-----
MHV	KPVIWLGHEE	ASLKSALT---	-----YFNRP	SVVCENKFNV	LPVDVSEPTD	KGPVPAAVLV
AIBV	SKLPLTLKVR	GIKS-----	-----VV	DFRSKDGFIY	KLTPDTD---	-----
SARS CoV	KPIVWHINQA	TTKTTFKPNT	WCLRCLWSTK	PVDTSNSFEV	LAVEDTQGM	N-----
	.....|.....| 2105	.....|.....| 2115	.....|.....| 2125	.....|.....| 2135	.....|.....| 2145	.....|.....| 2155
EMCR	----FCPHRH	KLRSRVK---	-----	-----	-FVNGRVVIT	NVGEPIISQP
229E	----YCVHGI	KYYSRVR---	-----	-----	-SVRGRAIIV	SVEQLEPCAQ
PEDV	----LCPHGL	NYIGKVV---	-----	-----	-VVKGTITIV	NVKGKPVVAPS
TGEV	----TCVHGV	SVNVKVT---	-----	-----	-QIKGTVAIT	SLIGPIIG--
OV43	----DGGDSS	ESGAKK---	-----	-----	TKEINIIKLS	GVKKPKFKVED
BoCoV	----DGGDIS	ESDAKE---	-----	-----	PKEINIIKLS	GVKKPKFKVED
MHV	TGALSGAATA	PGTAKEQKVC	ASDSVVDQVV	SGFLSDLGSA	TVDVKEVKLN	GVKKPKFKVED
AIBV	-----	-----	-----	-----	--ENSKAPVY	YPVLDAISLK
SARS CoV	----LACESQ	QPTSEEVVEN	-----	-----	-PTIQKEVIE	CDVKTTEVVG
	.....|.....| 2165	.....|.....| 2175	.....|.....| 2185	.....|.....| 2195	.....|.....| 2205	.....|.....| 2215
EMCR	SKLLNGIAYT	TFS--GSFDN	GHYVVYDAAN	NAVYDGARLF	ASDLSTLAVT	AIVVVGGCVT
229E	SRLLSGVAYT	AFS--GPVDK	GHYTVYDTAK	KSMYDGDRLF	KHDLSSLVST	SVVMVGGYVA
PEDV	HLFLKGVSYT	TFLDNGNGVV	GHYTVFDHGT	GMVHDGDAFV	PGDLNVSPVT	NVVVSEQTAV
TGEV	-EVLEATGYI	CYS--GSNRN	GHYTYDNRN	GLVVDAEKAY	HFNRDLQVST	TAIASNFVVK
OV43	SVIVNDTSE	TKYVKSLSIV	DVYDMWLTGC	KYVVRTANAL	SRAVNVPTIR	KFIKFGMTLV
BoCoV	SVIVNDTSE	IKYVKSLSIV	DVYDMWLTGC	RCVVRTANAL	SRAVNVPTIR	KFIKFGMTLV
MHV	SVVVNDPTSE	TKVVKLSLSIV	DVYDMFELTGC	RYVVWMANEL	SRLVNSPTVR	EYVKGWMTKI
AIBV	AIWVEGNANF	VVG-----HP	NYYSKSLHIP	TFWENAENFV	KMGDKIGGVT	MGLWRAEHLN
SARS CoV	NVILKPSDEG	VKVTQELGHE	DLMAAYVENT	SITIKKPNEI	SLALGLKTIA	THGIAAINS
	.....|.....| 2225	.....|.....| 2235	.....|.....| 2245	.....|.....| 2255	.....|.....| 2265	.....|.....| 2275
EMCR	S-----	-----NVPP	IVSEKISVMD	KLDTG---AQ	KFFQFGDFVM	NNIVLFLTWL
229E	-----	-----PV	NTVKPKPVIN	QLDEK---AQ	KFFDFGDFLI	HNFIFFTWL
PEDV	V-----	-----IKDP	VKKAELDATK	LLDTMNYASE	RFFSFGDFMS	RNLITVFLYI
TGEV	KPQAEERPKN	CAFNKVAASP	KIVQEQLKLL	IESGANYALT	EFGRYADMFF	MAGDKILRL
OV43	SIP-----	-----IDLL	NLREIKPAVN	VVKAVRNKIS	VCFNFIKWLF	VLLFGWIKIS
BoCoV	SIP-----	-----IDLL	NLREIKPVFN	VVKAVRNKIS	ACFNFIKWLF	VLLFGWIKIS
MHV	VIP-----	-----AKLV	LLRDEKQEFV	APKVVAKAVI	ACYSAVKWFF	LYCFSWIKFN
AIBV	KPN-----	-----LERI	FNIKAIAIVG	SSVVTTCQCG	LIGKAATFIA	DKVGGGVVRN
SARS CoV	PWS-----	-----KILA	YVKPFLG---	--QAAITTSN	CAKRLAQRVF	NNYMPYVFTL
	.....|.....| 2285	.....|.....| 2295	.....|.....| 2305	.....|.....| 2315	.....|.....| 2325	.....|.....| 2335
EMCR	LSMFSLLRST	IMKHDIKVIA	KAPKRTGVIL	TRSFYKYNIRS	ALFVVVKQKWC	VIVTLFKFLL
229E	LSMFTLCKTA	VTTGDKVIMA	KAPQRTGVVL	KRSLKYNLKA	SAAVLKSKWW	LLAKFTKLL
PEDV	LSILGLCFRA	FRKRDVKVLA	GVPQRTGAIL	RKSMRYNAKA	LGVFVFLKLY	WFKVLGKFSL
TGEV	LEVFKYLLVL	FMCLRSTKMP	KVKVKP-PLA	FKDFGAKVRT	LNVMRQLNKP	SVWRYAKLV
OV43	ADNKVIYTTT	IASKLTCKLV	ALAFKNAPLT	FKWSMVARGA	CIIATIFLLW	FNFIYANVIF
BoCoV	ADNKVIYTTT	VASKLTCKLV	ALAFKNAPLT	FKWSMVARGA	CIIATIFLLW	FNFIYANVIF
MHV	TDNKVIYTTT	VASKLTFLNLC	CLAFKNALQT	FNWNVVSRGF	FLVATVFLW	FNFLYANVIL
AIBV	ITDSIKGLCG	ITRGHFERKM	SPQFLKTLMF	FLFYFLKASV	KSVVASVYKT	LCKVVLATLL
SARS CoV	LFQLCTFTKS	TNSRIRASLP	TTIAKNSVKS	VAKLCLDAGI	NYVKSPPKFSK	LFTIAMWLL
	.....|.....| 2345	.....|.....| 2355	.....|.....| 2365	.....|.....| 2375	.....|.....| 2385	.....|.....| 2395
EMCR	LLYAIYALVF	MIVQFSPFNS	LLCGDIVSGY	EKSTFN----	--KDIYCGNS	MVCKMCLFSY
229E	LIYTLYSVVL	LCVRFGPFN-	-FCSETVNGY	AKSNFV----	--KDDYCDGS	LGCKMCLFGY
PEDV	GIYALYALLF	MTIRFTPIGS	PVCDVAVAGY	ANSSFD----	--KNEYCN-S	VICKVCLYGY
TGEV	LLIAIYNFFY	LFVSIPVVKH	LTCNGAVQAY	KNSSFI----	--KSAVCGNS	ILCKACLASY
OV43	SDFYLPKIGF	LPTEVKGKIQ	WIKNTFSLVT	ICDLYSMQDV	GFKNQYCNCS	IACQCLAGF
BoCoV	SDFYLPKIGF	LPTEVKGKIQ	WIKNTFSLVT	ICDLYSIQDV	GFKNQYCNCS	IACQCLAGF
MHV	SDFYLPNIGF	FPTFVGQIVA	WVKTTFGIFT	LCDLYQVSDV	GYRSSFCNGS	MVCELCFSGF
AIBV	IVFVYTSNP	VMFTGIRVLD	FLFEGSLGCP	YKDYGK--DS	FDVLYRCADD	FCRVCLHDK
SARS CoV	LSICLGLSLIC	VTAAFGVLLS	NFGAPSYCNG	VRELYLNSSN	VTTMDFCEGS	FPCSICLSGL
	.....|.....| 2405	.....|.....| 2415	.....|.....| 2425	.....|.....| 2435	.....|.....| 2445	.....|.....| 2455
EMCR	QEFNDLDHTS	LVWKHIR---	-----D--P--	-ILISLQPFV	ILVILLIFGN	MYLRFGLLYF
229E	QELSQFSLHD	VVWKHIT---	-----D--P--	-LFSNMQPFV	VMVLLIFGD	NYLRFCFLLYF
PEDV	QELSDFSHTQ	VVWQHIL---	-----D--P--	-LIGNVMPFF	YLAFLAIFGG	VYVKAITLYF
TGEV	DELADFQHLQ	VTWDFKS---	-----D--P--	-LWNRLVQLS	YFAFLAVFGN	NYVRCFLMYF
OV43	DMLDNYKAID	VVQYEADRRR	FVDYTGVLKI	VIELIVSYAL	YTAWFYPLFA	LISIQILTWT
BoCoV	DMLDNYKAID	VVQYEADRRR	FVDYTGVLKI	VIELIVSYAL	YTAWFYPLFA	LISIQILTWT
MHV	DMLDNYDAIN	VVQHVVDRRV	SFDYISLFLK	VVELVIGYSL	YTVCFYPLFG	LIGMQLLTWT
AIBV	DSLHLKXKAY	SVEQVYKDAA	SG-----	--FIFNWNWL	YLVFLILFVK	PVAGFVICY
SARS CoV	DSLDSYPAL	TIQVTIS--S	YKLDLTILGL	AAEWVLAJML	FTKFFYLLGL	SAIMQVFFGY

	....|....| 2465	....|....| 2475	....|....| 2485	....|....| 2495	....|....| 2505	....|....| 2515
EMCR	VAQFISTFG-	-SFLGFHQKQ	WFLHFVPFDV	LCNEFLATFI	VCKIVLFVRH	IIVGCNNADC
229E	VAQMISTVG-	-VFLGYKETN	WFLHFIPFDV	ICDELLVTVI	VIKVISFVRH	VLFGCENPDC
PEDV	IFQYLNSLG-	-VFLGLQQSI	WFLQLVPFDV	FGDEIVVFFI	VTRVLMFIKH	VCLGCDKASC
TGEV	VSQYLNLWL-	-SYFGYVEYS	WFLHVVNFES	ISAEFVIVVI	VVKAVLALKH	IVFACSNPSC
OV43	LPELFMLST-	-LHWSFRLLV	ALANMLPAHV	FMRFYIIIAS	FIKLFSLFRH	VAYGCSKSGC
BoCoV	LPELMLST-	-LHWSVRLLV	SLANMLPAHV	FMRFYIIIAS	FIKLFSLFRH	VAYGCSKSGC
MHV	LPEFMLET-	-MHWSARFFV	FVANMLPAFT	LLRFYIVVTA	MYKIFCLCRH	VMYGCSRPQC
AIBV	CVKYLVLNST	VLQTVCFD	WVFQTVFSHF	NFMGAGFYFW	LFYKIYIQVH	HILYCKDVTG
SARS CoV	FASHFISN--	--SWLMWFII	SIVQMAPVSA	MVRMYIFFAS	FYYIWKSYVH	IMDGCTSSCT

	....|....| 2525	....|....| 2535	....|....| 2545	....|....| 2555	....|....| 2565	....|....| 2575
EMCR	VACSKSARLK	RVPLQTIING	MHKSFYVNAN	GGTCFCNKHN	FFCVNCDSFG	PGNTFFINGDI
229E	IACSKSARLK	RFPVNTIVNG	VQRSFYVNAN	GGSKFCCKHR	FFCVCDCSYG	YGSTFTTPEV
PEDV	VACSKSARLK	RVPVQTIQFQ	TSKSFYVHAN	GGSKFCCKHN	FFCLNCDSYG	PGCTFTINDVI
TGEV	KTCSTARQT	RIPIQVVVNG	SMKTYVYHAN	GTGKFCCKHN	FYCKNCDSYG	FENTFTICDEI
OV43	LFCYKRNRS	RVKCSITVGG	MIRYVDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFTITVEA
BoCoV	LFCYKRNRS	RVKCSITVGG	MIRYVDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFTITVEA
MHV	LFCYKRNRS	RVKCSITVGG	TLRYVDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFTITVEA
AIBV	EVCKVARSN	RQEVSVVVG	RKQIVHVTN	SGYNFCKRHN	WYCRNCDDYG	HQNTFTMSPEV
SARS CoV	MMCYKRNRS	RVECTTIVNG	MKRSFYVYAN	GGRGFCCKHN	WNCIDCDSYK	TGSTFTISDEV

	....|....| 2585	....|....| 2595	....|....| 2605	....|....| 2615	....|....| 2625	....|....| 2635
EMCR	ARELGNVVK	AVQPTAPAYV	IIDKVDVNG	FYRLYSGDTF	WRYDFDITES	KYSCKE----
229E	SRELGNITKT	NVQPTGPAYV	MIDKVEFENG	FYRLYSCETF	WRYNFDITES	KYSCKE----
PEDV	ATEVGNVVK	NVQPTGPATI	LIDKVEFSNG	FYRLYSGDTF	WRYNFDITES	KYSCKE----
TGEV	VRDLNSVVK	TVYATDRSHQ	EVTKVECSNG	FYRFYVGGDEF	TSYDYDVKKH	KYSCKE----
OV43	ALDLSKELKR	PIQPTDVAYH	TVTDVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
BoCoV	ALDLSKELKR	PIQPTDVAYH	TVTDVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
MHV	AADLSKELKR	PVNPTDSAYY	LVTEAKVQGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
AIBV	AGELSEKLR	HVKPTAYAYH	VVDEACLVDD	FVNLKYKAAT	PGKDSASSAV	KCFSTVDLFL
SARS CoV	ARDLSLQFKR	PINPTDQSSY	IVDSVAVKNG	ALHLYFDKAG	QKTYERHPLS	HFVNLDNLRA

	....|....| 2645	....|....| 2655	....|....| 2665	....|....| 2675	....|....| 2685	....|....| 2695
EMCR	-VLKNCNVLE	NFIVYNN--	-----SGSNI	TQIKNACVYF	SQLLCEPIKL	VNSELLSTLS
229E	-VFKNCNVLD	DFIVFNN--	-----NGTNV	TQVKNASVYF	SQLLCRPIKL	VNSELLSTLS
PEDV	-ALKNCNII	DFIVFNN--	-----NGSNV	NQVKNACVYF	SQMLCKPVKL	VDSALLASLS
TGEV	-VLKSMMLLD	DFIVYSP--	-----SGSAL	ANVRNACVYF	SQLIKPIKI	VNSDLLEDS
OV43	SKVKSVPMNH	VVVVEN----	-----DADK	ANFLNAAVFY	AQSLFRPILM	VDKNLITAN
BoCoV	SKVKSVPMNH	VVVVEN----	-----DADK	ANFLNAAVFY	AQSLFRPILM	VDKNLITAN
MHV	SKVKSVPMNH	VVVVEN----	-----EADK	AGFLNAAVFY	AQSLFRPILM	VEKLLITAN
AIBV	KAVFLKEALK	CEQISNDGFI	VCNTQSAHAL	EEAKNAAIYY	AQYLCKPILI	LDQALYEQLV
SARS CoV	NNTKGSPLIN	VIVFDGK--	-----SKCDE	SASKSASVYV	SQLMCQFILL	LDQVLVSDVG

	....|....| 2705	....|....| 2715	....|....| 2725	....|....| 2735	....|....| 2745	....|....| 2755
EMCR	--VDFNGVLH	KAYVDVLCNS	FFKELTANMS	MAECKATLGL	T-----	-----
229E	--VDFNGVLH	KAYIDVLRNS	FGKDLNANMS	LAECKRALGL	S-----	-----
PEDV	--VDFNGVLH	SAFVSVLSNS	FGKDLSSCND	MQDCKSTLGF	DD-----	-----
TGEV	--VDFNGVLH	NAKKNVIKNS	FNDVDSECKN	LDECYRACNL	N-----	-----
OV43	TGTSVTETMF	DVYVDTFSLM	FDVDDKSLNA	LIATAHSSIK	QGTQYKVL	TFLSCARKSC
BoCoV	TGTSVTETMF	DVYVDTFSLM	FDVDDKSLNA	LIATAHSSIK	QGTQYKVL	TFLSCARKSC
MHV	TGTSVTETMF	DVYVDTFSLM	FDVDDKSLNA	LIATAHSSIK	QGTQYKVL	TFLSCARKSC
AIBV	V-EPVSKSVI	DKVCSILSSI	ISVDTAALNY	KAGTLRDALL	S-----	-----
SARS CoV	DSTEVSVKMF	DAYVDTFSAT	FSVPMEKLKA	LVATAHSELA	KGVALDGVLS	TFVSAARQG-

	....|....| 2765	....|....| 2775	....|....| 2785	....|....| 2795	....|....| 2805	....|....| 2815
EMCR	-----VSDDD	FVSANVAHR	YDVLLSDLSF	NNFFISYAKP	EDK-LSVYDI	ACCMRAGSKV
229E	-----ISDHE	FTSAISNAHR	CDVLLSDLSF	NNFVSSYAKP	EEK-LSAYDL	ACCMRAGAKV
PEDV	-----VPLDT	FNAVAEVAHR	YDVLLTDMSE	NNFTTSYAKP	EEK-FPVHDI	ATCMRVGAKI
TGEV	-----VSFST	FEMAVNNAHR	FGILITDRSF	NNFWPSKVVP	GSSGVSAMDI	GKCMSTDAKI
OV43	SIDSDVDTKC	LADSVMSAVS	AGLELTDDESC	NNLVPTYLKS	DN--IVAADL	GVLIQNSAKH
BoCoV	SIDSDVDTKC	LADSVMSAVS	AGLELTDDESC	NNLVPTYLKS	DN--IVAADL	GVLIQNSAKH
MHV	SIDSDVDTKC	LADSVMSAVS	AGLELTDDESC	NNLVPTYLKS	DN--IVAADL	GVLIQNSAKH
AIBV	----ITKDEE	AVDMAIFCHN	HVDVYTGDF	TNVPISYIGD	TG-KLTPRDR	GFLINADASI
SARS CoV	VVDTDVDTKD	VIECLKLSHH	SDLEVTGDSC	NNFMTYKNV	EN--MTPRDL	GACIDCNARH

	....|....| 2825	....|....| 2835	....|....| 2845	....|....| 2855	....|....| 2865	....|....| 2875
EMCR	VNHNVLKES	IPIVWGVKDF	NTLSQEGKKY	LVKTTKAKGL	TFLLTENDNQ	AITQVP----
229E	VNHNVLKES	IPIVWGVKDF	NTLSQEGKKY	LVKTTKAKGL	TFLLTENDNQ	AITQVP----
PEDV	VNHNVLKES	IPIVWGVKDF	NTLSQEGKKY	LVKTTKAKGL	TFLLTENDNQ	AITQVP----
TGEV	VNHNVLKES	IPIVWGVKDF	NTLSQEGKKY	LVKTTKAKGL	TFLLTENDNQ	AITQVP----
OV43	VQAGVAKIAG	VSCIWSVDAF	NQLSSDFQHK	LKKACCKTGL	KLELTYNQKM	ANVSILT---
BoCoV	VQAGVAKIAG	VSCIWSVDAF	NQLSSDFQHK	LKKACCKTGL	KLELTYNQKM	ANVSILT---
MHV	VQAGVAKIAG	VSCIWSVDAF	NQLSSDFQHK	LKKACCKTGL	KLELTYNQKM	ANVSILT---
AIBV	ANLRVKN--A	PPVWVKFSEL	IKLSDSCLKY	LISATVKSQV	RFFITKSGAK	QVIACTH---
SARS CoV	INAQVAKSHN	VSLIWNVKDY	MSLSEQLRQK	IRSAARKNNI	PFRLTCATTR	QVNVNIT---

	2885	2895	2905	2915	2925	2935
EMCR	ATSIVAKQGA	G-----	--FKRTYNFL	WYVCLFVVAL	FIGVSFID--	---YTTTSTS
229E	ATSIVAKQGA	GD-----	--AGHSLTWL	WLLCGLVCLI	QFYLCFFMPY	--FMYDIVSS
PEDV	TVCIANKKGA	GLPS-----	--FSKVKKEF	WFLCLFVAA	FFALSFLD--	---FSTQVSS
TGEV	TESVSPKSGS	G-----	--FFDVITQL	KQIVILVFVF	IFICGLCSVY	SVATQSYIES
OV43	--TPFSLKGG	A--V-----	--FSYFVYVC	FVLSLVCFIG	---LWCLMPT	YTVHKSDFQL
BoCoV	--TPFSLKGG	A--V-----	--FSYFVYVC	FVLSLVCFIG	---LWCLMPT	YTVHKSDFQL
MHV	--TPFSLKGG	A--V-----	--FSKVLQWL	FVNLICFIV	---LWALMPT	YAVHKSDFQL
AIBV	QKLLVEKKAG	GIVSGTFKCF	KSYFKWLLIF	YILFTACCSG	YYYMEVSKSF	VHPMYDVNST
SARS CoV	--TKISLKGG	K--I-----	--VSTCFKLM	LKATLLCVLA	ALVCYIVMPV	HTLSIHDGYT

	2945	2955	2965	2975	2985	2995
EMCR	FHGYDFKYIE	NGQLKVFEAP	LHCVRNVFDN	FNQWHEAKFG	VVTNSDKCP	IVVG----VS
229E	FEGYDFKYIE	NGQLKNFEAP	LKCVRNVFEN	FEDWHYAKFG	FTPLNKQSCP	IVVG----VS
PEDV	DSYDFKYIE	SGQLKTFDNP	LSCVHNVFIN	FDQWHDAKFG	FTPVNPNSCP	IVVG----VS
TGEV	AEGYDYMVIK	NGIVQPFDDT	ISCVHNTYKG	FGDWFKAKYG	FIPTFGKSCP	IVVGT-VFDL
OV43	PVYASYKVLD	NGVIRDVSVE	DVCFANKFEQ	FDQWYESTFG	LSYYSNSMAC	PIVVA-VIDQ
BoCoV	PVYASYKVLD	NGVIRDVSVE	DVCFANKFEQ	FDQWYESTFG	LSYYSNSMAC	PIVVA-VVDQ
MHV	PLYASFVID	NGVLRDVTVT	DACFANKFIQ	FDQWYESTFG	LVYRNSRAC	PVVVA-VIDQ
AIBV	LHVEGFKVID	KGVLREIVPE	DTCFSNKFEV	FDAFWGRPYD	NSRNCPIVTA	VIDGDGTAT
SARS CoV	NEIGYKAIQ	DGVTRDIIST	DDCFANKHAG	FDWFSQRGG	S--YKNDKSC	PVVAA-IITR

	3005	3015	3025	3035	3045	3055
EMCR	ERINVPVGP	TNVYLVG---	-KTLVFTLQA	AFGNTGVCYD	FDGVTTS---	--DKCIFNSA
229E	EIVNTVAGIP	SNVYLVG---	-KTLIFTLQA	AFGNAGVCYD	IFGVTTT---	--EKCIFNSA
PEDV	DEARTVPGIP	AGVYLAG---	-KTLVFAINT	IFGTSGLCFD	ASGVADK---	--GACIFNSA
TGEV	ENMRPIPDP	AYSVIVG---	-RSLVFAINA	AFGVTNMCYD	HTGNAVSKDS	YFDTCVFNTA
OV43	DFGSTVFNV	TKVLRYG---	YHVLHFITHA	LSADGVQCYT	PHSQISYSNF	YASGCVLSSA
BoCoV	DFGSTVFNV	TKVLRYG---	YHVLHFITHA	LSADGVQCYT	PHSQISYSNF	YASGCVLSSA
MHV	DIGYTLFNV	TKVLRYG---	FHVLHFITHA	FATDSVQCYT	PHMQIPYDNF	YASGCVLSSS
AIBV	GVPGFVSWVM	DGVFIHMTQ	TERKPWYIPT	WFNREIVGYT	QDSIITEGSE	YTSIALFSAR
SARS CoV	EIGFIVPGLP	GTVLRAIN--	GDFLHFLPRV	FSAVGNICYT	PSKLIYESDF	ATSACVLAAE

	3065	3075	3085	3095	3105	3115
EMCR	CTRLEGLGGD	-NVYCYNTDL	IEGSKPYISL	QPNAYYKYDV	K-NYVRFPEI	LARGFGLRTI
229E	CTRLEGLGGN	-NVYCYNTAL	MEGSLPYSSI	QANAYYKYDN	G-NFIKLPV	IAQGFGRFTV
PEDV	CTTLTGLGGT	-AVYCYKNG	VEGAKLYSEL	APHSYKMYD	G-NAVSLPEI	ISRGFGIRTI
TGEV	CTTLTGLGGT	-IVYCAKQGL	VEGAKLYSDL	MPDYIEHAS	G-NMVKLPAI	IR-GLGLRFV
OV43	CTMTMADGS	PQPYCYTEGL	MNASLYSSL	VPHVRYNLAN	AKGFIRFPEV	LREGL-VRIV
BoCoV	CTMTMADGS	PQPYCYTEGL	MNASLYSSL	VPHVRYNLAN	AKGFIRFPEV	LREGL-VRIV
MHV	CTMLAHADGT	PHPYCYTEGI	MNASLYDSL	APHVRYNLAN	SNGYIRFPEV	VSEGI-VRIV
AIBV	CLYLITASNT	QLYCFNGDND	AGALPFGSI	IPHRVYFQPN	GVRLIVPQOI	LHPTP---VV
SARS CoV	CTIFKDAMGK	PVPYCYDTNL	LEGSISYSEL	RPDTRYVLMD	G-SIIQFPNT	YLEGS-VRVV

	3125	3135	3145	3155	3165	3175
EMCR	RTIATRYCRV	GECDRSHKGV	CFGFDKQWYN	DGRVD---DG	YICGDGLIDL	LVNVLISFSS
229E	RTIATRYCRV	GECDRSHKGV	CFGFDKQWYN	DGRVA---NG	YVCGTGLWNL	VFNILSMFSS
PEDV	RTKATRYCRV	GQCVQSAEGV	CFGADRFFVY	NAESG---SD	FVCGTGLFTL	LMNVISVFSK
TGEV	KTQATRYCRV	GECDISKAGF	CFGGDNWFVY	DNEFG---NG	YICGNSVLGF	FKNVFKLFNS
OV43	RTSRMSYCRV	GLCEEADEGI	CFNFGSWVL	NNDYYRSLPG	TFCGRDVFDL	IYQLFKGLAQ
BoCoV	RTSRMSYCRV	GLCEEADEGI	CFNFGSWVL	NNDYYRSLPG	TFCGRDVFDL	IYQLFKGLAQ
MHV	RTSRMTYCRV	GLCEDAEEGV	CFNFGSSWVL	NNPYRAMPG	TFCGRNADF	IHQVLGGLVR
AIBV	KFVDSYCRG	SVCEYTRPGY	VNLSNPQWVL	FNDEYTSKPG	VFCGSTVREL	MFMSVSTFFT
SARS CoV	TTFDAEYCRH	GTCEERSEVG	CLSTSGRWVL	NNEHYRALSG	VFCGVDAMNL	IANIFTPLVQ

	3185	3195	3205	3215	3225	3235
EMCR	SFSVVAAMSGH	MLFNFLFAAF	ITFLCLVTK	FKRVFGDLSY	GVFTVVCATL	INNISYVVTQ
229E	SFSVVAAMSGQ	ILLNCALGAF	AIFCCFLVTK	FRMFVGDLSV	GVCTVVAVL	LNNVSYIVTQ
PEDV	TVPTVLSGQ	ILFNCLIAFV	AVAVCFLETK	FKRMFGDMSV	GVFTVGACTL	LNNVSYIVTQ
TGEV	NMSVVAATSGA	MLVNIIIAFL	AIAMCYGVK	FKKIFGDCFT	LIVMIIVTLV	VNNVSYIVTQ
OV43	PVDFLALTAS	SIAGAILAVI	VVLGFYYLIK	LKRAFGDYTS	VVFVNIVVWC	VNFMMFLFVQ
BoCoV	PVDFLALTAS	SIAGAILAVI	VVLGFYYLIK	LKRAFGDYTS	IVFVNIVVWC	VNFMMFLFVQ
MHV	PIDFFALTAS	SVAGAILAVI	VVLAFYYLIK	LKRAFGDYTS	VVVINIVVWC	INFMLFVQ
AIBV	GVN-PNIYMQ	LATMFLILV	VVLIFAMV	FQGVFKAYAT	TVFITMLVWV	INAFILCVHS
SARS CoV	PVGALDVSAS	VVAGGIIAIL	VTCAAYYFMK	FRRVFGYENH	VVAANALLFL	MSFTILCLVP

	3245	3255	3265	3275	3285	3295
EMCR	N-LFFMLLYA	ILYFVFTRTV	R--YAWIWHI	AYIVAYFLLI	PWWLLTWFSF	AAFLELLPNV
229E	N-LVTMIAIA	ILYFFATRS	R--YAWIWHI	AYLIAYISFA	PWWLCAWYFL	AMLTGLLPSL
PEDV	N-TLGMGLYA	TLYFLCTKGV	R--YMWIWHL	GFLISYILIA	PWWVLMVYAF	SAIEFFMPNL
TGEV	N-TFFMIIYA	IVYFFITRKL	A--YPGILDA	GFIAYINMA	PWYVITAYIL	VFLYDSLPSL
OV43	VYPILSCVYA	ICFYATLYF	PSEISVIMHL	QWLVMYGTIM	PLWFCLLYIA	VVVSNHAFVW
BoCoV	VYPILSCVYA	ICFYATLYF	PSEISVIMHL	QWLVMYGTIM	PLWFCLLYIS	VVVSNHAFVW
MHV	VYPILSCLYA	CFYFYTTLYF	PSEISVIMHL	QWLVMYGAIM	PLWFCLLYIA	VVVSNHALWL
AIBV	YNSVLAVILL	VLYCYASLTV	SRNTVIMHC	WLVTFTGLIV	PTWLACCYLG	FIIYMYTPLF
SARS CoV	AYSFLPGVYS	VFLYLYTFYF	TNDVSFLAHL	QWFAMFSPIV	PFWITAIYVF	CISLKHCHWF

	3305	3315	3325	3335	3345	3355
EMCR	FKLKISTQ--	--LFEGDKFI	GTFESAAAGT	FVLDMRSYER	LINT--ISPE	KLKNYAASYN
229E	LKLKVSTN--	--LFEGDKFV	GTFESAAAGT	FVIDMRSYER	LANS--ISPE	KLKSYAASYN
PEDV	FKLKVSTQ--	--LFEGDKFV	GSFENAAAGT	FVLDMHAYER	LANS--ISTE	KLRQYASTYN
TGEV	FKLKVSTN--	--LFEGDKFV	GNFESAAAGT	FVIDMRSYET	IVNS--TSIA	RIKSYANSFN
OV43	FSYCRKLG--	--TSVR--SD	GTFEEMALTT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
BoCoV	FSYCRQLG--	--TSVR--SD	GTFEEMALTT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
MHV	FSYCRKLG--	--TEVR--SD	GTFEEMSLTT	FMITKESYCK	LKNS--VSDV	AFNRYLSLYN
AIBV	LWCYGTTKNT	RKLYDGNEFV	GNYDLAAKST	FVIRGSEFVK	LTNE---IGD	KFEAYLSAYA
SARS CoV	FNNYLKRK--	--VMFNGVTF	STFEEAALCT	FLLNKEMYLK	LRSETLLPLT	QYNRYLALYN

	3365	3375	3385	3395	3405	3415
EMCR	KYKYYSGSAS	EADYRCACYA	HLAKAMLDDYA	-KDHNMLYS	PPTISYN-ST	LQSGLKMAQ
229E	RYKYYSGNAN	EADYRCACYA	YLAKAMLDIFS	-RDHNDILYT	PPTVSYG-ST	LQAGLRKMAQ
PEDV	KYKYYSGSAS	EADYRLACFA	HLAKAMMDYA	-SNHNDTLYT	PPTVSYN-ST	LQAGLRKMAQ
TGEV	KYKYITGSMG	EADYRMACYA	HLGKALMDYS	-VNRTDMLYT	PPTVSVN-ST	LQSGLRKMAQ
OV43	KYRYYSKGMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMN
BoCoV	KYRYYSKGMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMN
MHV	KYRYFSKGMD	TAAYREAACS	QLAKAMETFN	HNNGNDVLYQ	PPTASVTTSF	LQSGIVKMFV
AIBV	RLKYYSGTGS	EQDYLAQACRA	WLYALDQYR	-NSGVEIVYT	PPRYSIGVSR	LQSGFKKLVS
SARS CoV	KYKYFSGALD	TTSYREAACC	HLAKALNDFS	-NSGADVLYQ	PPQTSITSAV	LQSGFRKMAF

	3425	3435	3445	3455	3465	3475
EMCR	PSGCVERCVV	RVCYGSTVLN	GVWLGDVTVC	PRHVIAPSTT	VL-IDYDHAY	STMRLHNFSV
229E	PSGVVEKCVV	RVCYGNVTLN	GLWLGDIVYC	PRHVIASNTT	SA-IDYDHEY	SIMRLHNFSI
PEDV	PSGVVEKCVV	RVCYGNVTLN	GLWLGDIVYC	PRHVIASNTT	SA-IDYDHEY	SIMRLHNFSI
TGEV	PSGLVEPCIV	RVSYGNNVLN	GLWLGDIVYC	PRHVIASNTT	ST-IDYDYAL	SVLRLHNFSI
OV43	PTSKVEPCIV	SVTYGNMTLN	GLWLDDKVYC	PRHVICSSAD	RV-INYENEM	SSVRLHNFSV
BoCoV	PTSKVEPCIV	SVTYGNMTLN	GLWLDDKVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSDFTV
MHV	PTSKVEPCIV	SVTYGNMTLN	GLWLDDKVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSDFTV
AIBV	PSSAVEKCVV	SVSYRGNLNL	GLWLDDKVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSDFTV
SARS CoV	PSGKVEGCMV	QVTCGTTTLN	GLWLDDTVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSDFTV

	3485	3495	3505	3515	3525	3535
EMCR	SHNG-VFLGV	VGVTMHGSVL	RIKVSQSNVH	TPKHVFETLK	PGASFNILAC	YEGIASGVFG
229E	ISGT-AFLGV	VGATMHGVTL	KIKVSTQNMH	TPRHSFRTLK	SGEGFNILAC	YDGAQGVFG
PEDV	SSGN-VFLGV	VSATMRGALL	QIKVQNQNVH	TPKYTYRTVR	PGESFNILAC	YDGAAGVYG
TGEV	SKNN-VFLGV	VSARYKGVNL	VLKVQNQNVN	TPEHKFKSIK	AGESFNILAC	YEGCPSGVYG
OV43	LFDR-LSLTV	MSYQMRGCM	VLTVTLQNSR	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
BoCoV	LFDR-LSLTV	MSYQMRGCM	VLTVTLQNSR	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
MHV	MSGR-MSLTV	MSYQMQGSL	VLTVTLQNP	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
AIBV	TTQHGVTNLV	VSRRLKGAFL	ILQTAVANAE	TPKYKFIKAN	CGDSFTIACA	YGGTVVGLYP
SARS CoV	QAGN-VQLRV	IGHSMQNCLL	RLKVDTSNPK	TPKYKFVRIQ	PGQTFSVLAC	YNGSPSGVYQ

	3545	3555	3565	3575	3585	3595
EMCR	VNLRTNFTIK	GSFINGACGS	PGYNVRNDGT	VEFCYLHQIE	LGSGAHVGS	FTGSVYGNFD
229E	VNMRTNWTIR	GSFINGACGS	PGYNLKN-GE	VEFVYMHQIE	LGSGSHVGS	FDGVMYGGFE
PEDV	VNMRSNYTIR	GSFINGACGS	PGYNINN-GT	VEFCYLHQIE	LGSGCHVGS	LDGVMYGGYE
TGEV	VNMRSQGTIK	GSFIAGTCGS	VGYYLEN-GI	LYFVYMHQIE	LGNGSHVGS	FEGEMYGGYE
OV43	VTMRSSYTIK	GSFLCGSCGS	VGVYIMG-DC	VKFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
BoCoV	VTMRSSYTIK	GSFLCGSCGS	VGVYIMG-DC	VKFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
MHV	VTMRSSYTIK	GSFLCGSCGS	VGVYIMG-DC	VKFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
AIBV	VTMRSSYTIK	GSFLCGSCGS	VGVYIMG-DC	VKFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
SARS CoV	CAMRPNHTIK	GSFLNGSCGS	VGFNIDY-DC	VSFVYMHQIE	LSTGCHTGT	FNGDFYGPYK

	3605	3615	3625	3635	3645	3655
EMCR	DQPSLQVESA	NMLSDNVVA	FLYAALLNGC	R-----WWL	RSTRVNVDGF	NEWAMANGYT
229E	DQPNLQVESA	NQMLTVNVVA	FLYAALLNGC	T-----WWL	KGEKLFVEHY	NEWAQANGFT
PEDV	DQPTLQVEGA	SSLFTENVLA	FLYAALINGS	T-----WWL	SSSRIAVDRF	NEWAVHNGMT
TGEV	DQPSMQLEGT	NVMSSDNVVA	FLYAALINGE	R-----WFV	TNTSMSLESY	NTWAKTNSFT
OV43	DAQVQQLLIQ	DYIQSVNFVA	WLYAAILNNC	N-----WFV	QSDKCSVEDE	NVWALSNGFS
BoCoV	DAQVQQLPVQ	DYIQSVNFVA	WLYAAILNNC	N-----WFV	QSDKCSVEDE	NVWALSNGFS
MHV	DAQVQQLPVQ	DYIQSVNFVA	WLYAAILNRC	N-----WFV	QSDKCSLEEF	NVWAMTNGFS
AIBV	DEEVAQRVPP	DNLVTNIVVA	WLYAAILSVK	ESSFSLPKWL	ESTTVSVDDY	NKWAGDNGFT
SARS CoV	DRQTAQAAGT	DTTITLNVLA	WLYAAVINGD	R-----WFL	NRFTTTLNDF	NLVAMKYNYE

	3665	3675	3685	3695	3705	3715
EMCR	IVSSVEC--Y	SILAAGTGVS	VEQLLASIQH	LHE-GFGGKN	ILGYSSLCDE	FTLAEVVKQM
229E	AMNGEDA--F	SILAAGTGVC	VERLLHAIQV	LNN-GFGGKQ	ILGYSSLNDE	FSINEVVKQM
PEDV	TVGNTDC--F	SILAAGTGVD	VQRLLASIQS	LHK-NFGGKQ	ILGHTSLTDE	FTTGEVVRQM
TGEV	ELSSDA--F	SMLAAGTQGS	VEKLLDSIVR	LNN-GFGGRT	ILSYGSLCDE	FTPTVIRQM
OV43	QVKSDEL--I	DALASMTGVS	LETLLAAIKR	LKN-GFQGRQ	IMGSCSFEDE	LTPSDVYQQL
BoCoV	QVKSDEL--I	DALASMTGVS	LETLLAAIKR	LKN-GFQGRQ	IMGSCSFEDE	LTPSDVYQQL
MHV	SIKADLV--L	DALASMTGVT	VEKLLAAIKR	LYS-GFQGKQ	ILGSCVLEDE	LTPSDVYQQL
AIBV	PFSTSTA--I	TKLSAITGVD	VQKLLRTIMV	KNS-QWGGDP	ILGQYNFEDE	LTPSEVENQI
SARS CoV	PLTQDHVDIL	GPLSAQTGIA	VLDMAALKE	LLQNGMNGRT	ILGSTILEDE	FTPFVVRQC

	....|....| 3725	....|....| 3735	....|....| 3745	....|....| 3755	....|....| 3765	....|....| 3775
EMCR	YGVNLQS---	GKVI FGLKTM	FLFSVFFTMF	WAELEFIYTNT	IWINPVILTP	IFCLLLFLSL
229E	FGVNLQS---	GKTTSMFKSI	SLFAGFFVMF	WAELEFVYTTT	IWVNPGLFPT	FMILLVALSL
PEDV	YGVNLQG---	GYVSRACRNV	LLVGSFLTFF	WSELVSYTKF	FWVNPYGVTP	MFACLSLLSS
TGEV	YGVNLQA---	GKVSFFFYPI	MTAMTILFAF	WLEFFMYTPF	TWINPTFVSI	VLAVTTLIST
OV43	AGIKLQSKRT	RLFKGTVCWI	MASTFLFSCI	ITAFVKWTFM	MYVTNNMFS-	ITFCALCVIS
BoCoV	AGIKLQSKRT	RLVKGIVCWI	MASTFLFSCI	ITAFVKWTFM	MYVTNNMLS-	ITFCALCVIS
MHV	AGVKLQSKRT	RVVKGTCWCW	LASTLLFCSI	ISAFVKWTFM	MYVTTHMLG-	VTLCALCFVS
AIBV	GGVRLQS---	-SFVRKATSW	FWSRCVLACF	LFVLCAIVLF	TAVPLKFYVY	AAVILLMAVL
SARS CoV	SGVTFOGKFK	KIVKGTHHWM	LLTFLTSLLI	LVQSTQWSLF	FFVYENAFLP	FTLGIMAIAA

	....|....| 3785	....|....| 3795	....|....| 3805	....|....| 3815	....|....| 3825	....|....| 3835
EMCR	VLTMFLKHKF	LFLQVFLLP	VIATALYN--	--CVLDYYIV	KFLADHFN-Y	NVSVLQMDVQ
229E	CLTFVVKHKV	LFLQVFLLP	IIVAAIQN--	--CAWDYHVT	KVLAEKFD-Y	NVSVQMMDIQ
PEDV	LLMFTLKHKF	LFFQVFLIPA	LIVTSCIN--	--LAFDVEVY	NYLAEHFD-Y	HVSLMGFNAQ
TGEV	VFVSGIKHKM	LFFMSFVLPS	VILVTAHN--	--LWDFSYY	ESLQSIVENT	NTMFLPVDMQ
OV43	LAMLLVKKHK	LYLTMYITPV	LFTLLYNNY-	-LVVYKHTFR	GYVYAWLSY	VPSVEYTYTD
BoCoV	LAMLLVKKHK	LYLTMYIIPV	LFTLLYNNY-	-LVVYKQTFR	GYVYAWLSY	VPSVEYTYTD
MHV	FAMLLVKKHK	LYLTMFIMPV	LCTLFYNTY-	-LVVYKQSF	GLAYAWLSH	VPAVDYTYMD
AIBV	FISFTVKHVM	AYMDTFLLP	LITVIGVCA	EVPPFIYNTLI	SQVIFLSQW	YDPVVDFTMV
SARS CoV	CAMLLVKKHK	AFLCLFLLPS	LATVAYFN--	-MVYMPASWV	MRIMTWLELA	DTSLSGYRLK

	....|....| 3845	....|....| 3855	....|....| 3865	....|....| 3875	....|....| 3885	....|....| 3895
EMCR	GLVNVLVCLF	VVFH---TW	RFSKERFTHW	FTYVCSLIAV	AYTYFYSGD-	-----F
229E	GFVNIFICLF	VALLH---TW	RFACKRCHTW	CTYLESLIAV	LYTALYSYD-	-----Y
PEDV	GLVNVFVCFV	VTILHGTYT	REFN-TPASS	VTYVVALLTA	AYNYFYASD-	-----I
TGEV	GVMLTVFCFI	VFTYTSVRFF	TCKQSWFSLA	VTTILVIFNM	VKIFGTSDEP	WTENQIAFCF
OV43	EVIYGMILLV	GMVFVTLRSI	NHDLFSFIMF	VGRVISVVS	WYMGSNLEEE	-----I
BoCoV	EVIYGMILLV	GMVFVTLRSI	NHDLFSFIMF	VGRVISVVS	WYMGSNLEEE	-----I
MHV	EVLVGVLLV	AMVFVTMRSI	NHDFVSVMFL	VGRVLVSLVM	WYFGANLEEE	-----V
AIBV	PWMFLPLVLY	TAFKCVQGCY	MNSFNTSLLM	LYQFVKLGFE	IYTSNTLTA	YTEGNWELF
SARS CoV	DCVMYASALV	LLILMTARTV	YDDAARRVWT	LMNVITLVYK	VYGNALDQA	-----I

	....|....| 3905	....|....| 3915	....|....| 3925	....|....| 3935	....|....| 3945	....|....| 3955
EMCR	LSLVMLFLCA	ISSDWYIGAI	VFLRSRLIIF	FSPE--SVFS	VFGDVKLTIV	VYLICGYLVC
229E	VSLVMLLCA	ISNEWYIGAI	IFRICKFGVA	FLPV--EYVS	YFDGVKTIVL	FYMLLGFVSC
PEDV	LSCAMTLFAS	VTGNWFGAV	CYKVAVMAL	RFP---TFVA	IFGDIKSVMF	CYLVLGYFTC
TGEV	VNMLTMIVSL	TTKDWVVIA	SYRIAYYIVV	CVMP-SAFVS	DFGFMKICSI	VYMACGYLFC
OV43	LLMLASLFGT	YTWT---TVL	SMIAKAVIAK	WVAVNVLYFT	DIPQIKIVLL	CYLFIGYIIS
BoCoV	LLMLASLFGT	YTWT---TAL	SMAAKAVIAK	WVAVNVLYFT	DIPQIKIVLV	CYLFIGYIIS
MHV	LLFLTSLFGT	YTWT---TML	SLATAKAVIAK	WLAVNVLYFT	DVPQVKLVLL	SYLCIGYVCC
AIBV	ELVHTVLAN	VSSNSLIGLF	VFKCAKWMY	YCN-----AT	YLNHYVLMV	MVNCIGWLCT
SARS CoV	SMWALVISVT	SNYSGVVTTI	MFLARAIVFV	CVEYYPPLFI	TGNTLQCIML	VYCFLGYCCC

	....|....| 3965	....|....| 3975	....|....| 3985	....|....| 3995	....|....| 4005	....|....| 4015
EMCR	TYWGILYWFN	RFFKCTMGVY	DFKVSAAEFK	YMVANGLHAP	YGPFDALWLS	FKLLGIGGDR
229E	MYGILLYWIN	RFCKCTLGIV	DFCVSPAEFK	YMVANGLNAP	NGPFDALFLS	FKLMGIGGPR
PEDV	CFYGILYWFN	RFFKVSUGVY	DYTVSAAEFK	YMVANGLRAP	TGTLDSLILLS	AKLIGIGGER
TGEV	CYYGILYWFN	RFTCMTCGVY	QFTVSAAELK	YMTANLNSAP	KNAYDAMILS	AKLIGVGGKR
OV43	CYWGFLSLMN	SLFRMPLGVY	NYKISVQELR	YMNANGLRPP	KNSFEALMLN	FKLLGIGGVP
BoCoV	CYWGFLSLMN	SLFRMPLGVY	NYKISVQELR	YMNANGLRPP	KNSFEALMLN	FKLLGIGGVP
MHV	CYWGVLSSLN	SIFRMPGLGV	NYKISVQELR	YMNANGLRPP	RNSFEALVLN	FKLLGIGGVP
AIBV	CYFGLYVWVN	KVFGTLTGKY	NYKISVQELR	YMCILHKNPP	KTVWEVFTSN	ILIQGIGGDR
SARS CoV	CYFGLFCLLN	RYFRLTLGVY	DYLVSTQEF	YMNQGLLPP	KSSIDAFKLN	IKLLGIGGKP

	....|....| 4025	....|....| 4035	....|....| 4045	....|....| 4055	....|....| 4065	....|....| 4075
EMCR	CIKISTVQSK	LTDLKCTNVV	LLGCLSSMNI	AANSSEWAYC	VDLHNKINLC	DDPEKAQGML
229E	TIKISTVQSK	LTDLKCTNVV	LLGCLSSMNI	ASNSKEWAYC	VEMHNKINLC	DDPETAQELL
PEDV	NIKISSVQSK	LTDIKCSNVV	LLGCLSSMNV	SANSTEWAYC	VDLHNKINLC	NDPEKAQEML
TGEV	NIKISTVQSK	LTEMKCTNVV	LLGLSKMHV	ESNSKEWNYC	VGLHNEINLC	DDPEIVLEKL
OV43	IIIEVSQFQSK	LTDVKCANVV	LLNCLQHLHV	ASNSKLWHYC	STLHNEILAT	SDLSVAFEKL
BoCoV	IIIEVSQFQSK	LTDVKCANGG	LLNCLQHLHV	ASNSKLWQYC	STLHNEILAT	SDLSVAFEKL
MHV	VIEVSQIQSR	LTDVKCVNVV	LLNCLQHLHI	ASSSKLWQYC	STLHNEILAT	SDLSVAFDNL
AIBV	VLPTATVQAK	LSDVKCTTVV	LLMQLTKLVN	EANSKMHVYL	VELHNKILAS	DDVGEMDKL
SARS CoV	CIKVATVQSK	MSDVKCTSVV	LLSVLQQLRV	ESSSKLWQYC	VQLHNDILLA	KDTTEAFEKM

	....|....| 4085	....|....| 4095	....|....| 4105	....|....| 4115	....|....| 4125	....|....| 4135
EMCR	LALLAFFLSK	HSDFG-----	-LDGLIDSYF	DNSSTLQSV	SSFVSMPSYI	AYENARQAYE
229E	LALLAFFLSK	HSDFG-----	-LDGLVDSYF	ENDSILQSV	SSFVGMPSFV	AYETARQEYE
PEDV	LALLAFFLSK	NSAFG-----	-LDDLLESYF	NDNSMLQSV	STYVGLPSYV	IYENARQQYE
TGEV	LALLAFFLSK	HNTCD-----	-LSEILSYF	ENTTLQSV	SAYAALPSWI	ALEKARADLE
OV43	AQLLIVLFAN	PAAVDSKCLT	SIEEVCDDYA	KDNTVLQALQ	SEFVNMAFV	EYEVAKKNLD
BoCoV	AQLLIVLFAN	PAAVDSKCLT	SIEEVCDDYA	KDNTVLQALQ	SEFVNMAFV	EYEVAKKNLD
MHV	AQLLVVLFAN	PAAVDSKCLA	SIEEVSDDYV	RDSTVLQALQ	SEFVNMAFV	EYELAKKNLD
AIBV	LGMLITLFCI	DSTID-----	-LSEVCDDIL	KRSTVLQSVT	QEFSHIPSYA	EYERAKNLYE
SARS CoV	VSLLSVLLSM	QGAVD-----	-INRLCEEML	DNRATLQAI	SEFSSLP	AYATAQEAYE

	4145 4155 4165 4175 4185 4195
EMCR	DAIANGSS-- --SQLIKQLK RAMNIAKSEF DHEISVQKKI NRMAEQAAATQ MYKEARSVNR
229E	NAVANGSS-- --PQIIKQLK KAMNVAKAEF DRESSVQKKI NRMAEQAAAA MYKEARAVNR
PEDV	DAVNGGSP-- --PQLVKQLR HAMNVAKSEF DREASTQRKL DRMAEQAAAQ MYKEARAVNR
TGEV	EAKKNDVS-- --PQILKQLT KAFNIAKSDF EREASVQKKL DKMAEQAAAS MYKEARAVDR
OV43	EAREFSGSAN-- --QQQLKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
BoCoV	EACSSGSAN-- --QQQLKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
MHV	EAKASGSAN-- --QQQIKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
AIBV	KVLVDSKNGG VTQQLAAYR KAANIAXSVF DRDLAVQKKL DSMAERAMTT MYKEARVTDK
SARS CoV	QAVANGDS-- --EVVLKKLK KSLNVAKSEF DRDAAMQRKL EKMAEQAMTQ MYKQARSEDK

	4205 4215 4225 4235 4245 4255
EMCR	KSKVISAMHS LLFGMLRRLD MSSVETVLNL ARDGVVPLSV IPATSASKLT IVSPDLESYS
229E	KSKVVSAMHS LLFGMLRRLD MSSVDTILNM ARNGVVPLSV IPATSAARLV VVVPDHDSEFV
PEDV	KSKVVSAMHS LLFGMLRRLD MSSVDTILNL AKDGVVPLSV IPAVSATKLN IVTSDIDSYN
TGEV	KSKIVSAMHS LLFGMLKKLD MSSVNTIIDQ ARNGVLPLSI IPASATRLV VITPSLEVF
OV43	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVPPLNA IPSLAANTLN IIVDPKSVYD
BoCoV	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVPPLNA IPSLAANTLT IIVDPKSVYD
MHV	KSKVVSALQT MLFSMIRKLD NQALNSILDN AVKGCVPPLNA IPSLTSNTLT IIVDPKQVFD
AIBV	RAKLVSSLHA LLFSLMKKID SEKNLVLFQD ASSGVVPLAT VPIVCSNKLTV IIVDPETWV
SARS CoV	RAKVTSAMQT MLFTMLRKLD NDALNNIINN ARDGCVPPLNI IPLTTAAKLM VVVPDYGTYK

	4265 4275 4285 4295 4305 4315
EMCR	KIVCDGSVHY AGVVWTLNDV KDNDGRPVHV KEITRENVET LT-----WPL ILNCERVVK-
229E	KMMVDGFVHY AGVVWTLQEV KDNDGKNVHL KDVTKENQEI LV-----WPL ILTCERVVK-
PEDV	RIQREGCVHY AGTIWNIIDI KDNDGKVHVH KEVTAQNAES LS-----WPL VLGCERIVK-
TGEV	KIRQENNVHY AGAIWTIVEV KDANGSHVHL KEVTAANELN LT-----WPL SITCERTTK-
OV43	QVVNDVYVYTY AGNVWQIQTI QDSGDTNKQL NEISDDCN-- -----WPL VIIANRYNE-
BoCoV	QVVNDVYVYTY AGNVWQIQTI QDSGDTNKQL NEISDDCN-- -----WPL VIIANRYNE-
MHV	QVVNDVYVYTY AGNVWHIQSI QDADGAVKQL NEIDVNIT-- -----WPL VIIANRYNE-
AIBV	KQVEGVHVTY STVVWNIDTV IDADGTELHP TSTGSGLYTC ISGANIAWPL KVNLTNRNGH
SARS CoV	NTCDGNTFTY ASALWEIQVQ VDAADSKIVQL SEINMDNSPN LA-----WPL IVTALRAN--

	4325 4335 4345 4355 4365 4375
EMCR	----LQ-NNE IMPGKLKQKP MKAEG--DGG VLGDNALYN TEGGKTFMYA YISNKADLKF
229E	----LQ-NNE IMPGKMKVKA TKGEG--DGG ITSEGNALYN NEGGRAFMYA YVTTKPGMKY
PEDV	----LQ-NNE IIPGKLKQRS IKAEG--DG- IVGEGKALYN NEGGRTFMYA FISDKPDLRV
TGEV	----LQ-NNE IMPGKLKERA VRASATLDGE AFGSGKALMA SESGKSFMYA FIASDNNLKY
OV43	VSATVLQNNNE LMPAKLKIQV VNSGPDQTCN TPT--QCYYN NSNNGKIVYA ILSDVDGLKY
BoCoV	VSATVLQNNNE LMPAKLKTQV VNSGPDQTCN TPT--QCYYN NSYNGKIVYA ILSDVDGLKY
MHV	VSSVVLQNNNE LMPQKLRTQV VNSGSDMNCN TPT--QCYYN TTGMGKIVYA ILSDCDGLKY
AIBV	KVDVVLQNNNE LMPHGVKTKA CVAGVDQAHK SVES-KCYT NISGNSVVA GATSNPNLKV
SARS CoV	-SAVKLQNNNE LSPVALRQMS CAAGTTQTAC TDDNALAYYN NSKGGFRVLA LLSHDQDLKW

	4385 4395 4405 4415 4425 4435
EMCR	VKWEYEGG-- CNTIELDSPC RFMVETPNGP QVKYLYFVKV LNTLRRGAVL GFIGATIRLQ
229E	VKWEHDSG-- VVTVELEPPC RFVIDTPTGP QIKYLYFVKV LNNLRRGAVL GYIGATVRLQ
PEDV	VKWEFDGG-- CNTIELEPPR KFLVDSPNGA QIKYLYFVRN LNTLRRGAVL GYIGATVRLQ
TGEV	VKWESSND-- IIPIELEAPL RFYVDGANGP EVKYLYFVKV LNTLRRGAVL GYIGATVRLQ
OV43	TKILKDDGN-- FVLELDPPC KFTVQDAKGL KIKYLYFVKV CNTLARGWVV GTISSVRLQ
BoCoV	TKILKDDGN-- FVLELDPPC KFTVQDVKGL KIKYLYFVKV CNTLARGWVV GTISSVRLQ
MHV	TKIVKEDGN-- CVVLELDPPC KFSVQDVKGL KIKYLYFVKV CNTLARGWVV GTISSVRLQ
AIBV	ASFLEAGN-- QIYVLDLPPC KFGMKVGVK EVVYLYFIKN TRSIVRGMV GATSNVVLQ
SARS CoV	ARFPKSDGTG TIYTELEPPC RFVTDTPKGP KVKYLYFIK LNNLNRGMV GSLAATVRLQ

	4445 4455 4465 4475 4485 4495
EMCR	AG-KQTElav NSGLLTACAF SVDPATTYLE AVKHGAKPVS NCIKMLSNGA GNGQAITSV
229E	AG-KQTEFVS NSHLLTHCSF AVDPAAAYLD AVKQGAQPVG NCVKMLTNGS GSGQAITSCTI
PEDV	AG-KQTEQAI NSSLLTLCAF AVDPAKTYID AVKSGHKPVG NCVKMLANGS GNGQAVTINGV
TGEV	AG-KPTEHPS NSSLLTLCAF SPDPAKAYVD AVKRGMQPVN NCVKMLSNGA GNGMAVINGV
OV43	AG-TATEYAS NSSILSLCAF SVDPKKTYLD FIQQGGTPIA NCVKMLCDHA GTGMAITVKP
BoCoV	AG-TATEYAS NSSILSLCAF SVDPKKTYLD FIQQGGTPIA NCVKMLCDHA GTGMAITVKP
MHV	AG-TATEYAS NSAIRSLCAF SVDPKKTYLD YIQGGAPVT NCVKMLCDHA GTGMAITIKP
AIBV	SKGHEEEVD AVGILSLCSF AVDPADTYCK YVAAGNQPLG NCVKMLTVHN GSGFAITSKP
SARS CoV	AG-NATEVPA NSTVLSFCF AVDPAKAYKD YLASGGQPI NCVKMLCTHT GTGQAITSVP

	4505 4515 4525 4535 4545 4555
EMCR	DANTNQDSYG GASCLYCRA HVPHP----S MDGYCKFKGK CVQVP-IGCL DPIRFLCLEN
229E	DSNTTQDTYG GASVCIYCRA HVAHP----T MDGFCQYKKG WVQVP-IGTN DPIRFLCLEN
PEDV	EASTNQDSYG GASVCLYCRA HVEHP----S MDGFCRLKKG YVQVP-LGTV DPIRFLVEND
TGEV	EANTQDQSYG GASVCIYCRC HVEHP----A IDGLCRYKKG FVQIP-TGTQ DPIRFLCIENE
OV43	DATTSQDSYG GASVCIYCRA RVEHP----D VDGLCKLRGK FVQVP-VGIK DPVSFVLTHD
BoCoV	DATTSQDSYG GASVCIYCRA RVEHP----D VDGLCKLRGK FVQVP-VGIK DPVSFVLTHD
MHV	EANTNQDSYG GASVCIYCRS RVEHP----D VDGLCKLRGK FVQVP-LGK DPVSFVLTHD
AIBV	SPTPDQDSYG GASVCLYCRA HIAHPGVSNG LDGRCQFKGS FVQIP-TTEK DPVGFCLRNK
SARS CoV	EANMDQESFG GASCLYCRC HIDHP----N PKGFCDLKKG YVQIPTTCAN DPVGFCLRNK

	4565	4575	4585	4595	4605	4615
EMCR	VCNVCGCWL	HGCACDRTTI	QSVDIS----	YLNRRARGSSA	-ARLEPCN-G	TDIDKCVRAF
229E	VCKVCGCWLN	HGCTCDRTAI	QSFDNS----	YLNRRVRGSSA	-ARLEPCN-G	TDIDYCVRAF
PEDV	VCKVCGCWL	NGCTCDRSIM	QSTDYG----	LFKRVRGSSA	-ARLEPCN-G	TDTQHVYRAF
TGEV	VCVVCGCWLN	NGCMCDRTSM	QSFTVDQSY-	LFKRVRGSSA	-ARLEPCN-G	TDPDHVSRAF
OV43	VCRVCGFWRD	GSCSCVSTDT	TVQSKDTN--	FFKRVRGTSV	DARLVPCASG	LSTDVQLRAF
BoCoV	VCQVCGFWRD	GSCSCVSTDT	TVQSKDT---	FFKRVRGTSV	DARLVPCASG	LSTDVQLRAF
MHV	VCQVCGFWRD	GMFLCR-HRL	PVSVKRHE--	LFKRVRGTSV	NARLVPCASG	LSTDVQLRAF
AIBV	VCTVCQCWIG	YGCQCDSLRQ	PKSSVQS----	----VAGASD	FDKNYLN--	YGVAVRLGMF
SARS CoV	VCTVCGMWKG	YGCSCDQLRE	PLMQSADAST	FLNRVCGVSA	-ARLTPCGTG	TSTDVVYRAF

	4625	4635	4645	4655	4665	4675
EMCR	DIYNKNVSFL	GKCLKMNCVR	FKNADLK---	-DGYFVIKRC	TKSVMHEEQS	MYNLLNFSGA
229E	DVYNKDAFI	GKNLKSNCVR	FKNVDKD---	-DAFYIVKRC	IKSVMDEHQS	MYNLLKGCNA
PEDV	DIYNKDVAFL	GKFLKVNCR	LKNLDKH---	-DAFYVVKRC	TKSVMHEEQS	IYSRLEKCGA
TGEV	DIYNKDVAFL	GKFLKTNCNR	FRNLDKH---	-DAYYIVKRC	TKTVMDEHQS	CYNDLKDSGA
OV43	DIYNASVAGI	GLHLKVNCCR	FORVDENGDK	LDQFFVVKRT	DLTIYNREMK	CYERVKDCKE
BoCoV	DICNASVAGI	GLHLKVNCCR	FORVDENGDK	LDQFFVVKRT	DLTIYNREME	CYERVKDCKE
MHV	DICNANRAGI	GLYKVNCCR	FORADEGNT	LDKFFVIKRT	NLEVYNKEKE	CYELTKECGV
AIBV	QNLKRNCARF	QELADTEDGN	LEYLDS----	---YFVVKQT	TPSNYEHEKS	CYEDLKS-EV
SARS CoV	DIYNEKVAGF	AKFLKTNCCR	FQEKDEEGNL	LDSYFVVKRH	TMSNYQHEET	IYNLVKDCPA

	4685	4695	4705	4715	4725	4735
EMCR	LAEHDFFTWK	DGRVIYGNVS	RHNLTKYTMM	DLVYAMRNFD	EQNCDVLKEV	LVLTGCCDNS
229E	VAKHDFFTWH	EGRTIYGNVS	RQDLTKYTMM	DLCFALRNFD	EKDCEVFKEI	LVLTGCCSTD
PEDV	IAEHDFFTWK	DGRAIYGNVC	RKDLTEYTMM	DLCYALRNFD	ENNCVVLKSI	LKVGACEES
TGEV	VAEHDFFTYK	EGRCFEGNVA	RRNLTKYTMM	DLCYAIRNFD	EKNCEVLKEI	LVTVGACEE
OV43	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTML	DLCYALRHFD	RNDCMLLCDI	LSIYAGCEQS
BoCoV	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTML	DLCYALRHFD	RNDCMLLCDI	LSIYAGCEQS
MHV	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTML	DLCYALRHFD	RNDCMSTLKEI	LLTYAECDES
AIBV	TADHDFEFVN	KN---IYNIS	RQRLTKYTMM	DFCYALRHFD	PKDCEVLKEI	LVTYGCIEDY
SARS CoV	VAHDFEFKFR	VDGDMVPHIS	RQRLTKYTMA	DLVYALRHFD	EGNCDTLKEI	LVTYNCCDD

	4745	4755	4765	4775	4785	4795
EMCR	----YFDSKG	WYDFVENEDI	HRVYASLGKI	VARAMLKCA	LCDAMVAKGV	VGVLTLDNQD
229E	----YFEMKN	WYDFVENEDI	HRVYALGKI	VANAMLKCA	FCDEMVLKGV	VGVLTLDNQD
PEDV	----YFNNKV	WYDFVENEDI	HRVYALLGTI	VARAMLKCA	FCDAIVEQGI	VGVLTLDNQD
TGEV	----YFENKD	WYDFVENEDI	HEVYAKLGPI	VANAMLKCA	FCDAIVEKGY	IGVITLDNQD
OV43	----YFTKKD	WYDFVENPDI	INVYKKGPI	FNALVSATE	FADKLVEVGL	VGVLTLDNQD
BoCoV	----YFTKKD	WYDFVENPDI	INVYKKGPI	FNALVSATE	FADKLVEVGL	VGVLTLDNQD
MHV	----YFQKKD	WYDFVENSDI	INVYKKGPI	FNALLNTAK	FADTLVEAGL	VGVLTLDNQD
AIBV	HPKWFEEKD	WYDFVENSKY	YVMLAKMGPI	VRALLNAIE	FGNLMVEKGY	VGVLTLDNQD
SARS CoV	----YFNKKD	WYDFVENPDI	LRVYANLGER	VRQSLKTVQ	FCDAIMRAGI	VGVLTLDNQD

	4805	4815	4825	4835	4845	4855
EMCR	LNGNFYDFGD	FVVSPLPMGV	PCCTSYYSYM	MPIMGLTNCL	ASECFVKSDI	FGSDFKTFDL
229E	LNGNFYDFGD	FVLCPPMGMI	PYCTSYYSYM	MPVMGMTNCL	ASECFMKSDI	FGQDFKTFDL
PEDV	LNGNFYDFGD	FTCSIKMGV	PICTSYYSYM	MPVMGMTNCL	ASECFVKSDI	FGEDFKSYDL
TGEV	LNGNFYDFGD	FVKTAGPGFC	ACVTSYYSYM	MPLMGMTSCL	ESENFVKSDI	YGSDFKQYDL
OV43	LNGKWFYDFGD	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNN--	---AYRLFDL
BoCoV	LNGKWFYDFGD	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNN--	---AYRLFDL
MHV	LYGQWYDFGD	FVKTVPGCGV	AVADSYYSYM	MPMLTMCHAL	DSELFING--	---TYREFDL
AIBV	LNGKWFYDFGD	FQKTAPGAGV	PVEDTSYYSYM	MPIIAMTDAL	APERYFEYDV	H-KGYKSYDL
SARS CoV	LNGNWFYDFGD	FVQVAPGCGV	PIVDSYYSLL	MPILTLTRAL	AAESHMDADL	A-KPLIKWDL

	4865	4875	4885	4895	4905	4915
EMCR	LKYDFTEHKE	NLFNKYFKHW	SFDYHPNCSD	CYDDMCVHC	ANFNTLFATT	IPGTAFGPLC
229E	LKYDFTEHKE	NLFNKYFKYW	GQDYHPNCVD	CHDEMCLHC	SNFNTLFATT	IPNTAFGPLC
PEDV	LEYDFTEHKT	ALFNKYFKYW	GLQYHPNCVD	CSDEQCIHVC	ANFNTLFSTT	IPITAFGPLC
TGEV	LAYDFTEHKE	YLFQKYFKYW	DRTYHPNCSD	CTSDECIHVC	ANFNTLFSTT	IPMTAFGPLV
OV43	VQYDFTDYKL	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIHC	ANFNILFSMV	LPNTCFGPLV
BoCoV	VQYDFTDYKL	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIHC	ANFNILFSMV	LPNTCFGPLV
MHV	VQYDFTDYKL	ELFNKYFKYW	SMTYHPNTCE	CEDDRCIHC	ANFNILFSMV	LPNTCFGPLV
AIBV	LKYDYTEEKQ	ELFQKYFKYW	DQYHYHPNCRD	CSDDRCILHC	ANFNILFSTL	IPQTSFGPLV
SARS CoV	LKYDFTEERL	CLFDRYFKYW	DQTYHPNCIN	CLDDRCILHC	ANFNVLSTV	FPPTSFGPLV

	4925	4935	4945	4955	4965	4975
EMCR	RKVFIDGVPL	VTTAGYHFKQ	LGLVWKNQDV	THSVRLTITE	LLQFVTDPSL	IIASSPALVD
229E	RKVFIDGVPL	VATAGYHFKQ	LGLVWKNQDV	THSTRLTITE	LLQFVTDPTL	IVASSPALVD
PEDV	RKCVIDGVPL	VTTAGYHFKQ	LGLVWNNQDV	LHSSRLSINE	LLQFCSDPAL	LIASSPALVD
TGEV	RKVHIDGVPL	VTTAGYHFKQ	LGLVWNNQDV	LDMTKLSMTD	LLRFVTDPTL	LVASSPALVD
OV43	RQIFVDGVVFF	VVSIGYHYKE	LGIVMNMVDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD
BoCoV	RQIFVDGVVFF	VVSIGYHYKE	LGIVMNMVDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD
MHV	RQIFVDGVVFF	VVSIGYHYKE	LGIVMNMVDV	THRYRLSLKD	LLLYAADPAL	HVASASALLD
AIBV	RKVFVDGVVFF	IATCGYHSKE	LGIVMNMQDV	MSFSKMGSLQ	LMQFVGDPAL	LVGTSNNLVD
SARS CoV	RKIFVDGVVFF	VVSTGYHFRE	LGIVMNMQDV	LHSSRLSFKE	LLVYAADPAM	HAASGNLLLD

	4985	4995	5005	5015	5025	5035
EMCR	QRTICFSVAA	LSTGLTNQVV	KPGHFNEEFY	NFLRLRGFFD	EGSELTCLKHF	FFAQNGDAAV
229E	KRTVCFSVAA	LSTGLTSQTV	KPGHFNFKEFY	DFLRSQGFFD	EGSELTCLKHF	FFTQKGDAAI
PEDV	QRTVCFSVAA	LGTGMTNQTV	KPGHFNFKEFY	DFLLEQGFFS	EGSELTCLKHF	FFAQKVDAAV
TGEV	QRTVCFSIAA	LSTGITYQTV	KPGHFNFKDFY	DFITERGFFE	EGSELTCLKHF	FFAQGGGEAAM
OV43	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKHf	FFTQDGNAAI
BoCoV	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFILSKGLLK	EGSSVDLKHf	FFTQDGNAAI
MHV	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	EFILSKGLLK	EGSSVDLKHf	FFTQDGNAAI
AIBV	LRTSCFSVCA	LTSGITHQTV	KPGHFNFKDFY	DFAEKAGMFK	EGSSIPLKHf	FYPQTGNAAI
SARS CoV	KRTTCFSVAA	LTNNVAFQTV	KPGNFNFKDFY	DFAVSKGFFK	EGSSVELKHf	FFAQDGNAAI

	5045	5055	5065	5075	5085	5095
EMCR	KDFDFYRYNK	PTILDICQAR	VTYKIVSRYF	DIYEGGCICA	CEVVVTNLNK	SAGWPLNKFg
229E	KDFDYRYRNR	PTMLDIOQAR	VAYQVAARYF	DCYEGGCITS	REVVVVTNLNK	SAGWPLNKFg
PEDV	KDFDYRYRNR	PTVLDICQAR	VVYQIVQRYF	DIYEGGCITA	KEVVVTNLNK	SAGYPLNKFg
TGEV	TDFNYYRYNR	VTVLDICQAA	FVYKIVGKYF	ECYDGGCINA	REVVVVTNYDK	SAGYPLNKFg
OV43	TDYNYKYNL	PTMVDIKQLL	FVLEVYKYF	EIYDGGCIPA	SQVIVNNYDK	SAGYPFNKFg
BoCoV	TDYNYKYNL	PTMVDIKQLL	FVLEVYKYF	EIYDGGCIPA	AQVIVNNYDK	SAGYPFNKFg
MHV	TDYNYKYNL	PTMVDIKQLL	FVLEVYKYF	EIYDGGCIPA	TQVIVNNYDK	SAGYPFNKFg
AIBV	NDYDYRYNR	PTMFDICQLL	FCLEVYSKYF	ECYEGGCIPA	SQVVVNLDK	SAGYPFNKFg
SARS CoV	SDYDYRYNL	PTMCDIRQLL	FVVEVVDKYF	DCYDGGCINA	NQVIVNNLDK	SAGFPFNKKG

	5105	5115	5125	5135	5145	5155
EMCR	KASLYYESIS	YEEQDALFAL	TKRNVLPMT	QLNLKYAISG	KERARTVGGV	SLLSTMTRQ
229E	KAGLYYESIS	YEEQDAIFSL	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLATMTTRQ
PEDV	KAGLYYESLS	YEEQDELYAY	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLSTMTRQ
TGEV	KARLYYETLS	YEEQDALFAL	TKRNVLPMT	QMNLYAISG	KARARTVGGV	SLLSTMTRQ
OV43	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISA	KNRARTVAGV	SILSTMTRGM
BoCoV	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISA	KNRARTVAGV	SILSTMTRGM
MHV	KARLYYEALS	FEEQDEVYAY	TKRNVLPMT	QMNLYAISA	KNRARTVAGV	SILSTMTRGM
AIBV	KARLYYEMS-	LEEQDQLFEI	TKKNVLPMT	QMNLYAISA	KNRARTVAGV	SILSTMTRQ
SARS CoV	KARLYYDSMS	YEDQDALFAY	TKRNVLPMT	QMNLYAISA	KNRARTVAGV	SICSTMTRQ

	5165	5175	5185	5195	5205	5215
EMCR	YHQKHLKSIV	NTRNATVVIG	TTKFYGGWNN	MLRTLIDGVE	NPMLMGWDYP	KCDRALPNMI
229E	FHQKCLKSIV	ATRNATVVIG	TTKFYGGWNN	MLKNLMADV	DPKLMGWDP	KCDRAMPSMI
PEDV	YHQKHLKSIV	NTRGASVVIG	TTKFYGGWNN	MLKNLIDGVE	NPCLMGWDYP	KCDRALPNMI
TGEV	YHQKHLKSIA	ATRNATVVIG	STKFYGGWNN	MLKNLMRDVD	NGCLMGWDYP	KCDRALPNMI
OV43	FHQKCLKSIA	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	NPVLMGWDP	KCDRAMPNLL
BoCoV	FHQKCLKSIA	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	NPVLMGWDP	KCDRAMPNIL
MHV	FHQKCLKSIA	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	SPVLMGWDP	KCDRAMPNIL
AIBV	FHQKILKSIV	NTRNASVVIG	TTKFYGGWNN	MLRNLIQGVE	DPILMGWDYP	KCDRAMPNLL
SARS CoV	FHQKLLKSIA	ATRGATVVIG	TSKFYGGWNN	MLKTVYSDVE	TPHLMGWDP	KCDRAMPNML

	5225	5235	5245	5255	5265	5275
EMCR	RMISAMVLGS	KHVNCCTVTD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDASTAYA
229E	RMLSAMILGS	KHVTCTASD	KFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA
PEDV	RMISAMILGS	KHTTCCSSTD	RFYRLCNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA
TGEV	RMASAMILGS	KHVGCCTHND	RFYRLSNELA	QVLTEVVHCT	GGFYFKPGGT	TSGDGTAYAY
OV43	RIVSSVLAR	KHETCCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
BoCoV	RIVSSVLAR	KHEACCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
MHV	RISSSVLAR	KHDSCCSHTD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
AIBV	RIAASVLAR	KHTNCCSWSE	RIYRLYNECA	QVLSETVLAT	GGIYVKPGGT	SSGDATTAYA
SARS CoV	RIMASVLAR	KHNTCCNLSH	RFYRLANECA	QVLSEVMCG	GSLYVKPGGT	SSGDATTAYA

	5285	5295	5305	5315	5325	5335
EMCR	NSIFNIFQAV	SSNINRLLSV	PSDSCNNVNV	RDLQRRLYDN	CYRLTSVEES	FIDDDYGYLR
229E	NSVFNIFQAV	SSNINCVLSV	NSSNCNNFNV	KKLQRLYDN	CYRNSNVDES	FVDDFYGYLQ
PEDV	NSVFNIFQAV	SANVNKLLSV	DSNVCHNLEV	KQLQRKLYEC	CYRSTIVDDQ	FVVEYGYLR
TGEV	NSAFNIFQAV	SANVNKLLGV	DSNACNNVTV	KSIQRKIYDN	CYRSSSIDEE	FVVEYFSYLR
OV43	NSVFNICQAV	SANVCALMSC	NGNKIEDLSI	RALQKRLYSH	VYRSDKVDST	FVTEYEFELN
BoCoV	NSVFNICQAV	SANVCALMSC	NGNKIEDLSI	RALQKRLYSH	VYRSDMVDST	FVTEYEFELN
MHV	NSVFNICQAV	SANVCSLMAC	NGHKIEDLSI	RELQKRLYSH	VYRADHVDPA	FVNEYYEFLN
AIBV	NSVFNIQAT	SANVARLLSV	ITRDIYVDNI	KSLQYELYQQ	VYRRVNFDP	FVEKFFSYLC
SARS CoV	NSVFNICQAV	TANVNALLST	DGNKIADKYV	RNLQHRLYEC	LYRNRDVEDH	FVDEFYAYLR

	5345	5355	5365	5375	5385	5395
EMCR	KHFSMMILSD	DGVVVCYNKY	AELGYIADIS	AFKATLYYQN	NVFMSTSKCW	VEEDLTGKGP
229E	KHFSMMILSD	DSVVCYNKTY	AGLGYIADIS	AFKATLYYQN	GVFMSTAKCW	TEEDLSIGPH
PEDV	KHFSMMILSD	DGVVVCYNNDY	ASLGYVADLN	AFKAVLYYQN	NVFMSTSKCW	IEPDINKGPH
TGEV	KHFSMMILSD	DGVVVCYNKY	ADLGYVADIN	AFKATLYYQN	NVFMSTSKCW	VEPDLSVGPH
OV43	KHFSMMILSD	DGVVVCYNSDY	ASKGYIANIS	AFQQVLYYQN	NVFMSESKCW	VEHDINNGPH
BoCoV	KHFSMMILSD	DGVVVCYNSDY	ASKGYIANIS	AFQQVLYYQN	NVFMSESKCW	VENDINNGPH
MHV	KHFSMMILSD	DGVVVCYNSEF	ASKGYIANIS	AFQQVLYYQN	NVFMSEAKCW	VETDIEKGP
AIBV	KNFSLMILSD	DGVVVCYNNTL	AKQGLVADIS	GFREVLYYQN	NVFMADSKCW	VEPDLEKGP
SARS CoV	KHFSMMILSD	DAVVVCYNSNY	AAQGLVASIK	NFKAVLYYQN	NVFMSEAKCW	TETDLTKGPH

	....|....| 5405	....|....| 5415	....|....| 5425	....|....| 5435	....|....| 5445	....|....| 5455
EMCR	EFCSQHTMQI	VDKDGTYYLP	YDPDSRILSA	GVFVDDVVK	DAVVLLXRYV	SLAIDAYPLS
229E	EFCSQHTMQI	VDENGKYYLP	YDPDSRIISA	GVFVDDITKT	DAVILLERYV	SLAIDAYPLS
PEDV	EFCSQHTMQI	VDKEGTYYLP	YDPDSRILSA	GVFVDDVVK	DAVVLLERYV	SLAIDAYPLS
TGEV	EFCSQHTLQI	VGPDDGYLLP	YDPDSRILSA	GVFVDDIVKT	DNVIMLERYV	SLAIDAYPLT
OV43	EFCSQHTMLV	KMDGDDVYLP	YPNPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
BoCoV	EFCSQHTMLV	KMDGDDVYLP	YPVPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
MHV	EFCSQHTMLV	KMDGDEVYLP	YDPDSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
AIBV	EFCSQHTMLV	EVDGEPKYL	YDPDSRILGA	GVFVDDVDKT	EPVAVMERYI	SLAIDAYPLV
SARS CoV	EFCSQHTMLV	KQGDDVYLP	YDPDSRILGA	GCFVDDIVKT	DGTLMIERFV	SLAIDAYPLT

	....|....| 5465	....|....| 5475	....|....| 5485	....|....| 5495	....|....| 5505	....|....| 5515
EMCR	KHPNSEYRKV	FYVLLDWVKH	LNKNLNEGVL	ESFSVTLLDN	QEDKFWCEDF	YASMYENSTI
229E	KHPKPEYRKV	FYALLDWVKH	LNKTLNEGVL	ESFSVTLLDE	HESKFWDESF	YASMYEKSTV
PEDV	KHENPEYKKV	FYVLLDWVKH	LYKTLNAGVL	ESFSVTLLDE	STAKFWDESF	YANMYEKSAV
TGEV	KHPKPAYQKV	FYTLLDWVKH	LQKNLNEGVL	DSFSVTMLLE	GQDKFWSEEF	YASLYEKSTV
OV43	YHENEYQKV	FRVYLAYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV
BoCoV	YHENEYQKV	FRVYLEYIKK	LYNELGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV
MHV	YHENPEYQNV	FRVYLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDETF	YKNMYLRSV
AIBV	HHENEYKKV	FFVLLAYIRK	YDPDSRILGA	MDYSFVMDID	KGSKFWEQEF	YENMYRAPTT
SARS CoV	KHPNQEYADV	FHLYLQYIRK	LHDELTHGML	DMYSVMLTND	NTSRYWEPEF	YEAMYPHTV

	....|....| 5525	....|....| 5535	....|....| 5545	....|....| 5555	....|....| 5565	....|....| 5575
EMCR	LQAAGLCVVC	GSQTVLRCDG	CLRKPLMCTK	CAYDHFVGTG	HKFILAITPY	VCNASGCGVS
229E	LQAAGLCVVC	GSQTVLRCDG	CLRRPMLCTK	CAYDHFVGTG	HKFILAITPY	VCNTSGCNVN
PEDV	LQSAGLCVVC	GSQTVLRCDG	CLRRPMLCTK	CAYDHFVGTG	HKFILAITPY	VCCASDCGVN
TGEV	LQAAGMCVVC	GSQTVLRCDG	CLRRPLLCTK	CAYDHVMGTG	HKFIMSITPY	VCSFNGCNVN
OV43	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN
BoCoV	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN
MHV	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CAYDHVMSTD	HKYVLSVSPY	VCNSPGCDVN
AIBV	LQSCGVCVVC	NSQTLRCSG	CIRKPLLCCK	CCYDHVMHTD	HKNVLSINPY	ICSQGLGCEA
SARS CoV	LQAVGACVLC	NSQTSLRCSG	CIRRPFLCCK	CCYDHVISTS	HKLVLVSNPY	VCNAPGCDVT

	....|....| 5585	....|....| 5595	....|....| 5605	....|....| 5615	....|....| 5625	....|....| 5635
EMCR	DVKKLYLGGL	NYICTNHKKPQ	LSFPLCSAGN	IFGLYKNSAT	GSLDVEVFNR	LATSDWTDVR
229E	DVTKLYLGGL	NYCYDHHKPH	LSFPLCSAGN	VFGLYKSSAL	GSMIDIVFNK	LSTDWSDIR
PEDV	DVTKLYLGGL	SYWCHHHKPR	LAFFPLCSAGN	VFGLYKNSAT	GSPDVEDFNR	IATSDWTDVS
TGEV	DVTKLYLGGL	SYICMHHKPPQ	LSFPLCANGN	VFGLYKSSAV	GSEAVEDFNK	LAVSDWTNVE
OV43	DVTKLYLGGM	SYICEDHKKPQ	YSFPLVMNGL	VFGLYKQSCT	GSPYIDDFNR	IASCWTDVD
BoCoV	DVTKLYLGGM	SYICEDHKKPQ	YSFPLVMNGL	VFGLYKQSCT	GSPYIDDFNR	IASCWTDVD
MHV	DVTKLYLGGM	SYICEDHKKPQ	YSFPLVMNGL	VFGLYKQSCT	GSPYIEDFNK	IASCWTEVD
AIBV	DVTKLYLGGM	SYFCGNHKKP	LSIPLVSNGT	VFGIYRANCA	GSENVDDFNQ	LATTNWSIVE
SARS CoV	DVTQLYLGGM	SYICKSHKPP	ISFPLCANGQ	VFGLYKNTCV	GSDNVTDVNA	IATCDWTNAG

	....|....| 5645	....|....| 5655	....|....| 5665	....|....| 5675	....|....| 5685	....|....| 5695
EMCR	DYKLANDVKD	TLRLFAAETI	KAKEESVKSS	YAFATLKEVV	GPKELLLSWE	SGKVKPPLNR
229E	DYKLANDAKE	SLRLFAAETV	KAKEESVKSS	YAYATLKEIV	GPKELLLSWE	SGKAKPPLNR
PEDV	DYRLANDVKD	SLRLFAAETI	KAKEESVKSS	YACATLHEVV	GPKELLLSWE	VGRPKPPLNR
TGEV	DYKLANNVKE	SLKIFAAETV	KAKEESVKSE	YAYAVLKEVI	GPKEIVLQWE	ASKTKPPLNR
OV43	DYILANECTE	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVKPPLNK
BoCoV	DYILANECTE	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVKPPLNK
MHV	DYVLANECTE	RLKLFAAETQ	KATEESFKQC	YASATIREIV	SDRELILSWE	IGKVRPPLNK
AIBV	PYILANRCS	SLRRFAAETV	KATEELHKQ	FASAEVREVF	SDRELILSWE	PGKTRPPLNR
SARS CoV	DYILANTCTE	RLKLFAAETL	KATEETFKLS	YGIATVREVL	SDRELHLSWE	VGKPRPPLNR

	....|....| 5705	....|....| 5715	....|....| 5725	....|....| 5735	....|....| 5745	....|....| 5755
EMCR	NSVFTCFQIS	KDSKFQIGEF	IFEKVEYGS	TVTYKSTVTT	KLVPGMIFVL	TSHNVQPLRA
229E	NSVFTCFQIT	KDSKFQVGEF	VFEKVDYGS	TVTYKSTATT	KLVPGMIFIL	TSHNVAPLRA
PEDV	NSVFTCYHIT	KNTKFQIGEF	VFEKAEYDND	AVTYKTATT	KLVPGMVFL	TSHNVQPLRA
TGEV	NSVFTCFQIS	KDTKIQLGEF	VFEQSEYGS	SVYYKSTSTY	KLTPGMIFVL	TSHNVSPKLA
OV43	NYVFTGYHFT	KNGKTVLGEY	VFDKSELT-N	GVYYRATTTY	KLSVGDVFL	TSHSVANLSA
BoCoV	NYVFTGYHFT	KNGKTVLGEY	VFDKSELT-N	GVYYRATTTY	KLSVGDVFL	TSHSVANLSA
MHV	NYVFTGYHFT	SNGKTVLGEY	VFDKSELT-N	GVYYRATTTY	KLSVGDVFL	TSHAVSSLSA
AIBV	NYVFTGYHFT	RTSKVQLGDF	TFEKGEGK-D	VVYYKATSTA	KLSVGDVFL	TSHNVVSLVA
SARS CoV	NYVFTGYRVT	KNSKVQIGEF	TFEKGDYD	AVVYRGTTY	KLVNGDYFVL	TSHTVMPLSA

	....|....| 5765	....|....| 5775	....|....| 5785	....|....| 5795	....|....| 5805	....|....| 5815
EMCR	PTIANQEKYS	SIYKLHPAFN	VSDAYANLVP	YYQLIGKQKI	TTIQGPPGSG	KSHCSIGLGL
229E	PTMANQEKYS	TIYKLHPFSN	VSDAYANLVP	YYQLIGKQRI	TTIQGPPGSG	KSHCSIGIGV
PEDV	PTIANQERYS	TIHKLHPAFN	IPEAYSSLVP	YYQLIGKQKI	TTIQGPPGSG	KSHCVIGLGL
TGEV	PILVNQEKYN	TISKLYPVFN	IAEAYNTLVP	YYQMIGKQKF	TTIQGPPGSG	KSHCVIGLGL
OV43	PTLVQENYS	SIR-FASVYS	VLETQNNV	NYQHIGMKRY	CTVQGPPTG	KSHLAIGLAV
BoCoV	PTLVQENYS	SIR-FASVYS	VLETQNNV	NYQHIGMKRY	CTVQGPPTG	KSHLAIGLAV
MHV	PTLVQENYT	SIR-FASVYS	VPETQNNV	NYQHIGMKRY	CTVQGPPTG	KSHLAIGLAV
AIBV	PTLCPOQTF	RFVNLRFNVM	VPETQNNV	LYHLVGKQKR	TTVQGPPTG	KSHFAIGLAV
SARS CoV	PTLVQEHYV	RITGLYPTLN	ISDEFSSNVA	NYQKVGMMQY	STLQGPPTG	KSHFAIGLAV

	5825	5835	5845	5855	5865	5875
EMCR	YYPGARIVFV	ACAAHAVDLSL	CAKAMTVYSI	DKCTRIIPAR	ARVECYSGFK	PNNTSAQYIF
229E	YYPGARIVFT	ACSHAAVDLSL	CAKAVTAYSV	DKCTRIIPAR	ARVECYSGFK	PNNNSAQYVF
PEDV	YYPGARIVFT	ACSHAAVDLSL	CVKASTAYSN	DKCSRIIPQR	ARVECYDGFK	SNNTSAQYLF
TGEV	YYPQARIVYT	ACSHAAVDAL	CEKAAKNFNV	DRCSRIIPQR	IRVDCYTGFK	PNNTNAQYLF
OV43	FYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVECYDKFK	INDTRKYYVF
BoCoV	YYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVECYDKFK	INDTRKYYVF
MHV	YYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVDCYDKFK	VNDOTRKYVF
AIBV	YFSSARVVFT	ACSHAAVDAL	CEKAFKFLKV	DDCTRIIPQR	TTVDCFSKFK	ANDTGKKYIF
SARS CoV	YYPGARIVYT	ACSHAAVDAL	CEKALKYLPF	DKCSRIIPAR	ARVECFDKFK	VNSTLEQYVF

	5885	5895	5905	5915	5925	5935
EMCR	STVNALPECN	ADIVVVDEVS	MCTNYDLSVI	NQRLSYKHIV	YVGDPQQLPA	PRVMITKGVN
229E	STVNALPEVN	ADIVVVDEVS	MCTNYDLSVI	NQRISYKHIV	YVGDPQQLPA	PRVLISKGVN
PEDV	STVNALPECN	ADIVVVDEVS	MCTNYDLSVI	NQRISYRHVV	YVGDPQQLPA	PRVMISRGTL
TGEV	CTVNALPEAS	CDIVVVDEVS	MCTNYDLSVI	NSRLSYKHIV	YVGDPQQLPA	PRTLKNGVL
OV43	TTINALPEMV	TDIVVVDEVS	MLTNYELSVI	NARIRAKHYV	YIGDPAQLPA	PRVLLSKGTL
BoCoV	TTINALPEMV	TDIVVVDEVS	MLTNYELSVI	NARIRAKHYV	YIGDPAQLPA	PRVLLSKGTL
MHV	TTINALPELV	TDIVVVDEVS	MLTNYELSVI	NSRVRRAHYV	YIGDPAQLPA	PRVLLNKGTL
AIBV	STINALPEVS	CDILLVDEVS	MLTNYELSVI	NGKINYQYVV	YVGDPQQLPA	PRTLNLN-GSL
SARS CoV	CTVNALPETT	ADIVVFDEIS	MATNYDLSVV	NARLRRAHYV	YIGDPAQLPA	PRTLNLTKGTL

	5945	5955	5965	5975	5985	5995
EMCR	EPVDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVNTVSELVY	ENKFVPVKPA	SKQCFKIFFK
229E	EPIDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVNTVSELVY	ENKFVPVKEA	SKQCFKIFER
PEDV	EPKDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVRTVSEMVY	ENQFIPVHPD	SKQCFKIFCK
TGEV	QPQDYNNVTQ	RMCTLGPDVF	LHKCYRCPAE	IVKTVSALVY	ENKFVPVNPPE	SKQCFKMFVK
OV43	EPKYFNTVTQ	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	ENKLKAKNES	SSLCFKVVYK
BoCoV	EPKYFNTVTQ	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	ENKLKAKNES	SSLCFKVVYK
MHV	EPYFNSVTQ	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	HNKLKAKNDN	SSMCFKVVYK
AIBV	SPKDYNNVTN	LMVCVKPDIF	LAKCYRCPKE	IVDTVSTLVY	DGKFIAANPE	SRECFKVIYN
SARS CoV	EPEYFNSVCR	LMKTIGPDMF	LGTCRRCPAE	IVDTVSALVY	DNKLKAHKDK	SAQCFKMFYK

	6005	6015	6025	6035	6045	6055
EMCR	---GNVQVDN	GSSINRRQLE	IVKLFVLKNP	SWSKAVFISP	YNSQNYVASR	FLGLQIQTV
229E	---GSVQVDN	GSSINRRQLD	VVKRFIHKNS	TWSKAVFISP	YNSQNYVAAR	LLGLQTQTV
PEDV	---GNVQVDN	GSSINRRQLD	VVRMFLAKNP	RWSKAVFISP	YNSQNYVASR	LLGLQIQTV
TGEV	---GQVQIES	NSSINRRQLE	VVKAFLAHNP	KWRKAVFISP	YNSQNYVARR	LLGLQTQTV
OV43	---GVTTHES	SSAVNMQQIY	LINKFLKANP	LWHKAVFISP	YNSQNFAAKR	VLGLQTQTV
BoCoV	---GVTTHES	SSAVNMQQIY	LINKFLKANP	LWHKAVFISP	YNSQNFAAKR	VLGLQTQTV
MHV	---GQTTHES	SSAVNMQQIY	LISKFLKANP	SWSNVAVFISP	YNSQNYVAKR	VLGLQTQTV
AIBV	NGNSDVGHES	GSAYNTQLE	FVKDFVCRNK	QWREAFISP	YNAMNQRAYR	MLGLNVQTV
SARS CoV	---GVITHDV	SSAINRPQIG	VVREFLTRNP	AWRKAVFISP	YNSQNAVASK	ILGLPTQTV

	6065	6075	6085	6095	6105	6115
EMCR	SSQGSEYDYV	IYAQTSDDTAH	ACNVNRFNVA	ITRAKKGIFC	VMCDKT-LFD	SLKFFEIKHA
229E	SAQGSEYDYV	IFAQTSDDTAH	ACNANRFNVA	ITRAKKGIFC	IMSDRT-LFD	ALKFFEITMT
PEDV	SSQGSEYDYV	IYAQTSDDTAH	ASNVNRFNVA	ITRAKKGILC	IMCDRS-LFD	LLKFFELKLS
TGEV	SAQGSEYDYV	IYTQTSDDTAH	ATNVNRFNVA	ITRAKVGILC	IMCDRT-MYE	NLDFYELKDS
OV43	SAQGSEYDYV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	ALQFTTLTLD
BoCoV	SAQGSEYDYV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	ALQFTTLTLD
MHV	SAQGSEYDYV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSSMQ-LFE	SLNFSTLTLD
AIBV	SSQGSEYDYV	IFCVTADSOH	ALNVNRFNVA	LTRAKRGILV	VMQRDELAYS	ALKFTELDSE
SARS CoV	SSQGSEYDYV	IFTQTTEETAH	SCNVNRFNVA	ITRAKIGILC	IMSDRD-LYD	KLQFTSLEIP

	6125	6135	6145	6155	6165	6175
EMCR	-----DLHSS	-QVCGLFKNC	TRTPNLPPPT	HAHTFLSLSD	QFKTTGDLAV	QIGS-N-NVC
229E	-----DLQSE	-SSCGLFKDC	ARNPIDLPPS	HATTYLSLSD	RFKTSGLDVA	QIGN-N-NVC
PEDV	-----DLQAN	-EGCGLFKDC	SRGDDLPPS	HANTFMSLAD	NFKTDQYLAV	QIGV-N-GPI
TGEV	KI-----GLQAK	PETCGLFKDC	SKSEQYIPPA	YATTYMSLSD	NFKTSDGLAV	NIG--T-KDV
OV43	KVPQAVETKV	QCSTNLFKDC	SKSYSGYHPA	HAPSFLAVDD	KYKATGDLAV	CLGIGD-SAV
BoCoV	KVPQAVETRV	QCSTNLFKDC	SKSYSGYHPA	HAPSFLAVDD	KYKATGDLAV	CLGIGD-SAV
MHV	KIN-----NPRL	QCTTNLFKDC	SRSYAGYHPA	HAPSFLAVDD	KYKVGGLAV	CLNVAD-SAV
AIBV	T-----S--	LQGTGLFKIC	NKEFSGVHPA	YAVTTKALAA	TYKVNDELAA	LNVNVEAGESEI
SARS CoV	RRN-VATLQA	ENVGTGLFKDC	SKIITGLHPT	QAPTHLSVDI	KFKTEG-LCV	DIPGIP-KDM

	6185	6195	6205	6215	6225	6235
EMCR	TYEHVISFMG	FRFDISIPGS	HSLFCTRDFA	IRNVRGWLG	DVESAHVCGD	NIGTNVPLQV
229E	TYEHVISYMG	FRFDVSMGPS	HSLFCTRDFA	MRHVRGWLG	DVEGAHVTDG	NVGTNVPLQV
PEDV	KYEHVISFMG	FRFDINIPNH	HTLFCTRDFA	MRNVRGWLG	DVEGAHVVG	NVGTNVPLQL
TGEV	KYANVISYMG	FRFEANIPGY	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVCGD	NVGTNVPLQL
OV43	TYSRILISLMG	FKLDVTLDDY	CKLFITKEEA	VKRVRWVG	DAEGAHAHTRD	SIGTNFPLQL
BoCoV	TYSRILISLMG	FKLDVTLDDY	CKLFITKEEA	VKRVRWVG	DAEGAHAHTRD	SIGTNFPLQL
MHV	TYSRILISLMG	FKLDLTLDDY	CKLFITRDEA	IRNVRAWVG	DAEGAHAHTRD	SIGTNFPLQL
AIBV	TYKHLISLLG	FKMSVNVGEG	HNMFITRDEA	IRNVRGWVG	DVEATHACGT	NIGTNLPPQV
SARS CoV	TYRRLISMMG	FKMNYQVNGY	PNMFITREEA	IRHVRWVG	DVEGCHATRD	AVGTNLPLQL

	6245	6255	6265	6275	6285	6295
EMCR	GFSNGVNFV	QTEGCVSTNF	GDVIKPVCAK	SPPGEQFRHL	VPFLRKGPW	LIVRRRIVQM
229E	GFSNGVDFVA	QPEGCVLTNT	GSVVKPVRR	APPGEQFTHI	VPLLRKGPW	SVLRKRIVQM
PEDV	GFSNGVDFV	RPEGCVVTES	GDYIKPVRR	APPGEQFAHL	LPLLRKGPW	DVVRKRIVQM
TGEV	GFSNGVDFV	QTEGCVITEK	GNSIEVVVKAR	APPGEQFAHL	IPLMRKGPW	HIVRRRIVQM
OV43	GFSTGIDFV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGHRW	DVVRPRIVQM
BoCoV	GFSTGIDFV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGQRW	DVVRPRIVQM
MHV	GFSTGIDFV	EATGMFAERD	GYVFKKAVAR	APPGEQFKHL	VPLMSRGQKW	DVVRIRIVQM
AIBV	GFSTGADFV	TPEGLVDTSI	GNNFEPVNSK	APPGEQFNHL	RVLFKSAKPW	HVIRPRIVQM
SARS CoV	GFSTGVNLVA	VPTGYVDTEN	NTEFTRVNAK	PPPGDQFKHL	IPLMYKGLPW	NVVRIRIVQM

	6305	6315	6325	6335	6345	6355
EMCR	ISDYLSNLSD	ILVFLWAGS	LELTTRMYFV	KIGP-IKYCY	CGNSATCYN	VSNEYCCFKH
229E	IADFLAGSSD	VLVFLWAGG	LELTTRMYFV	KIGA-VKHCQ	CGTVATCYN	VSNDYCCFKH
PEDV	CSDYLANLSD	ILIFVLWAGG	LELTTRMYFV	KIGP-SKSCD	CGKVATCYN	ALHTYCCFKH
TGEV	VCDYDFGLSD	ILIFVLWAGG	LELTTRMYFV	KIGR-PQKCE	CGKSATCYSS	SQSVYACFKH
OV43	FADHLIDLSD	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYYGCWRH
BoCoV	FADHLIDLSD	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	STKRATAYNS	RTGYYGCWRH
MHV	LSDHLVDLAD	SVVLVTWAAS	FELTCLRYFA	KVGKEVVCSV	CNKRATCFNS	RTGYYGCWRH
AIBV	LADNLGNVSD	CVVFVTWCHG	FELTCLRYFA	KIGK-EQVCS	CGSRATTFNS	HTQAYACWKH
SARS CoV	LSDTLKGLSD	RVVFLWAHG	FELTSMKYFV	KIGPERTCCL	CDKRATCFST	SSDTYACWNH

	6365	6375	6385	6395	6405	6415
EMCR	ALGCDYVYNP	YAFDIQWGY	VGSLSQNHHT	FCNIHRNEHD	ASGDAVMTRC	LAVHDCFVKH
229E	ALGCDYVYNP	YVIDIQWGY	VGSLSTNNHA	ICNVHRNEHV	ASGDAIMTRC	LAVYDCFVKH
PEDV	ALGCDYLYNP	YCIDIQWGY	KGSLSLNHHE	HCNVHRNEHV	ASGDAIMTRC	LAIHDCFVKH
TGEV	ALGCDYLYNP	YCIDIQWGY	TGSLSMNHHE	VCNIHRNEHV	ASGDAIMTRC	LAIHDCFVKH
OV43	SVTCDYLYNP	LIVDIQWGY	IGSLSSNHDL	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFCNN
BoCoV	SVTCDYLYNP	LIVDIQWGY	IGSLSSNHDL	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFCNN
MHV	SYSCDYLYNP	LIVDIQWGY	TGSLTSNHDL	ICSVHKGAHV	ASSDAIMTRC	LAVHDCFCCKS
AIBV	CLGDFVYVNP	LLVDIQWGY	SGNLQFNHDL	HCNVHGHAAV	ASVDAIMTRC	LAINNAFCQD
SARS CoV	SVGFDYVYNP	FMIDVQWGF	TGNLQSNHDL	HCQVHGNAHV	ASCDAIMTRC	LAVHECFVKR

	6425	6435	6445	6455	6465	6475
EMCR	VDWTVTPFI	ANEKFINGCG	RNVQGHVVRA	ALKLYKPSVI	HDIGNPKGVR	CA-VTDAKWY
229E	VDWSITYPMI	ANENAINKGG	RTVQSHIMRA	AIKLYNPKAI	HDIGNPKGIR	CA-VTDAKWY
PEDV	VDWSITYPMI	GNEAVINKSG	RIVQSHIMRS	VLKLYNPKAI	YDIGNPKGIR	CA-VTDAKWY
TGEV	VDWSIVYPFI	DNEEKINKAG	RIVQSHVMKA	ALKIFNPAAI	HDVGNPKGIR	CA-TTPIPFK
OV43	INWNVEYPII	SNELSINTSC	RVLQVRILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK
BoCoV	INWNVEYPII	SNELSINTSC	RVLQVRILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK
MHV	VNWSLEYPII	SNEVSVNTSC	RYLQVRMFRA	AMLCNRYDVC	YDIGNPKGLA	CV--KGDFDK
AIBV	VNWDLTYPHI	ANEDVNSSC	RLLQVRMYLNA	CVDALKVNVV	YDIGNPKGIK	CVRRGDVNF
SARS CoV	VDWSVEYPII	GDELRVNSAC	RKVQHMVVK	ALLADKFPVL	HDIGNPKAIK	CVPQAEVWK

	6485	6495	6505	6515	6525	6535
EMCR	CYDKQPVNSN	---VKLLDYD	YATHG--QLD	GLCLFWNCNV	DMYPEFSIVC	RFDTTRTSVF
229E	CYDKNPINSN	---VKTLEYD	YMTHG--QMD	GLCLFWNCNV	DMYPEFSIVC	RFDTTRSTL
PEDV	CFDKNPNTSN	---VKTLEYD	YITHG--QFD	GLCLFWNCNV	DMYPEFSVVC	RFDTTRCSRPL
TGEV	CYDRDPINNN	---VRCLDYD	YMHVG--QMN	GLMLFWNCNV	DMYPEFSIVC	RFDTTRRSKL
OV43	FYDAQPIVKS	---VKTLLYS	FEAHKDSFKD	GLCMFWNCNV	DKYPNNAVVC	RFDTRVNLNL
BoCoV	FYDAQPIVKS	---VKTLLYS	FEAHKDSFKD	GLCMFWNCNV	DKYPNNAVVC	RFDTRVNLNL
MHV	FYDASPVVKS	---VKQFVYK	YEAHKDQFLD	GLCMFWNCNV	DKYPANAVVC	RFDTRVNLNL
AIBV	FYDKNPVIRN	---VKQFEYD	YNHDKDKFAD	GLCMFWNCNV	DCYPDNLSVC	RYDTRNLVSF
SARS CoV	FYDAQPCSDK	AYKIEELFYS	YATHHDKFTD	GVCLFWNCNV	DRYPANAIVC	RFDTRVLSNL

	6545	6555	6565	6575	6585	6595
EMCR	NLEGVNGGSL	YVNKHAFHTP	AYDKRAFVKL	KPMPEFFYDD	SDCDVVQ---	-EQVNYVPLR
229E	NLEGVNGGSL	YVNNHAFHTP	AYDKRAMAKL	KPAPFFYYDD	GSCEVVH---	-DQVNYVPLR
PEDV	NLEGVNGGSL	YVNNHAFHTP	AFDKRAFAKL	KPMPEFFYDD	TECDKLQ---	-DSINYVPLR
TGEV	SLEGVNGGSL	YVNNHAFHTP	AYDRRAFAKL	KPMPEFFYDD	SNCELVD---	-GQPNYVPLR
OV43	NLPGCNGGSL	YVNKHAFHTK	PFARAFAEHL	KPMPEFFYSD	TPCVYMDGMD	AKQVDYVPLK
BoCoV	NLPGCNGGSL	YVNKHAFHTK	PFSRAFAEHL	KPMPEFFYSD	TPCVYMDGMD	AKQVDYVPLK
MHV	NLPGCNGGSL	YVNKHAFHTS	PFTRAFAFENL	KPMPEFFYSD	TPCVYMEGME	SKQVDYVPLR
AIBV	NLPGCNGGSL	YVNKHAFYTP	KFTDRIFFRN	KAMPFFYYSD	SPCETIQVDG	-VAQDLVSLA
SARS CoV	NLPGCDGGSL	YVNKHAFHTP	AFDKSAFTNL	KQLPFFYYSD	SPCESHGKQV	VSDIDYVPLK

	6605	6615	6625	6635	6645	6655
EMCR	ASSCVTRCNI	GGAVCSKHAN	LYQYVEAYN	TFTQAGFNIW	VPHSFDVYNL	WQIFIET-NL
229E	ATNCITKCN	GGAVCSKHAN	LYRAYVESYN	IFTQAGFNIW	VPTTFDCYNL	WQTFTEV-NL
PEDV	ASNCITKCN	GGAVCSKHCA	MYHSYVNAYN	TFTSAGFTIW	VPTSFDTYNL	WQTFESN-NL
TGEV	SNVCITKCN	GGAVCKKHAA	LYRAYVEDYN	IFMQAGFTIW	CPQNFDTYML	WHGFVNSKAL
OV43	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
BoCoV	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
MHV	SATCITRCNL	GGAVCLKHAE	DYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
AIBV	TKDCITKCN	GGAVCKKHQA	MYAEFVTSYN	AAVTAGFTFW	VTNKLNPYNL	WKSFA---L
SARS CoV	SATCITRCNL	GGAVCRHHAN	EYRQYLDAYN	MMISAGFSLW	IYKQFDTYNL	WNTFTK---L

	6665	6675	6685	6695	6705	6715
EMCR	QSLNIAFNV	VKKGCFTGVD	GELPVAVVND	KVFVRYGDVD	NLVFTNKTTL	PTNVAFELFA
229E	QGLNIAFNV	VNKGSEFVGAD	GELPVAISGD	KVEVRDGNVD	NLVFVNKTSL	PTNIAFELFA
PEDV	QGLNIAFNV	LKKGSFVGDE	GELPVAVVND	KVLVRDGTVD	TLVFTNKTSL	PTNVAFELYA
TGEV	QSLNIAFNV	VKKGAFTGLK	GDLPATAVIAD	KIMVRDGTVD	KCIFTNKTSL	PTNVAFELYA
OV43	QSLNIAFNV	VKTGHYTGQA	GEMPCAIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA
BoCoV	QSLNIAFNV	VKTGHYTGQA	GEMPCAIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA
MHV	QSLNIAFNV	VNAGHFDGRA	GELPCAVIGE	KVIAKIQNED	VVVFKNNTPF	PTNVAFELFA
AIBV	QSIDNIAYNM	YKGGHYDAIA	GEMPTVITGD	KVFVIDQGVE	KAVFVNQTTL	PTSVAFELFA
SARS CoV	QSLNIAFNV	VNKGHFDGHA	GEAPVSIINN	AVYTKVDGID	VEIFENKTTL	PVNVAFELWA
	6725	6735	6745	6755	6765	6775
EMCR	KRKMGLTPPL	SILKNLGVVA	TYKFVLWDYE	AERPFTSYTK	SVCKYTDNF-	-----EDV
229E	KRKVGLTPPL	SILKNLGVVA	TYKFVLWDYE	AERPLTSFTK	SVCGYTDFA-	-----EDV
PEDV	KRKVGLTPPI	TILRNLGVVC	TSKCVIWDYE	AERPLTTFK	DVCKYTDFE-	-----GDV
TGEV	KRKLGLTPPL	TILRNLGVVA	TYKFVLWDYE	AERPFSNFTK	QVCSYTDLD-	-----SEV
OV43	KRSVRHHPPEL	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTDLK-	-----FIDLK
BoCoV	KRSVRHHPPEL	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTDLK-	-----LIDLK
MHV	KRSVRHHPPEL	KLFRNLNIDV	CWKHVIWDYA	KDSVFCSSY	KVCKYTDLQ-	-----CIESL
AIBV	KRNIRTLNPN	RILKGLGVVD	TNGFVIWDYA	NQTPLYRNTV	KVCAYTDIE-	-----PNGL
SARS CoV	KRNIRTPPEI	KILNNLGVDI	AANTVIWDYK	REAPAHVSTI	GVCTMTDIK	KPTESACSSL
	6785	6795	6805	6815	6825	6835
EMCR	CVCFDNSIQG	SYERFTLTN	AVLFSTVVIK	N-----LTPIK	LNFGMLNGMP	VSSIKSDKGV
229E	CTCYDNSIQG	SYERFTLTN	AVLFSTVVIK	TGGKSLPAIK	LNFGMLNGNA	IATVKSSEDGN
PEDV	CTLFDNSIVG	SLERFSMTQN	AVLMSLTAVK	K-----LTGIK	LTQYGLNGVP	VN-----THED-
TGEV	VTCFDNSIAG	SFERFTTTRD	AVLISNNAVK	G-----LSAIK	LQYGLLNDLP	VS-----TVGN-
OV43	NVLFDGRDNG	ALEAFKRSNN	GVYISTTKVK	S-----LS	MIRGPPRAEL	NGVVVDKVG
BoCoV	NVLFDGRDNG	ALEAFKRSNN	GVYISTTKVK	S-----LS	MIRGPPRAEL	NGVVVDKVG
MHV	NVLFDGRDNG	ALEAFKRSNN	GVYISTTKVK	S-----LS	MIRGPPRAEL	NGVVVDKVG
AIBV	VVLVYDDR-YG	DYQSFLAADN	AVLSTQCYK	R-----YS	YVEIPSNLLV	QNGMPLKDG-
SARS CoV	TVLFDGRVEG	QVDLFRNARN	GVLITEGSVK	G-----LT	PSKGAQASV	NGVTLIGES-
	6845	6855	6865	6875	6885	6895
EMCR	EKLNVWYTYV	RKNGQFQDHY	DG-----	-----	-----	-----FYTQ
229E	IKNINWFYVY	RKDGKPVVDY	DG-----	-----	-----	-----FYTQ
PEDV	-KPFTWYIYT	RKNGKFEDYP	DG-----	-----	-----	-----YFTQ
TGEV	-KPFTWYIYT	RKNGEYVEQI	DS-----	-----	-----	-----YYTQ
OV43	-TDCVFYFAV	RKEGQDVIFS	QFDSLGVSSN	QSPQGNLGSN	GKPGNVGGND	ALSTISTIFTQ
BoCoV	-TDCVFYFAV	RKEGQDVIFS	QFDSLGVSSN	QSPQGNLGSN	-EPGNVGGND	ALATSTIFTQ
MHV	-SDVEFFWAM	RRDGDVIFS	RTGSLEPSHY	RSPQGNPGGN	-RVGDLGSNE	ALARGTIFTQ
AIBV	---ANLYVYK	RVNGAFVTLF	N-----	-----	-----	-----TINTQ
SARS CoV	-VKTQFNHYK	KVDG--IIQ-	-----	QLP-----	-----	-----ETYFTQ
	6905	6915	6925	6935	6945	6955
EMCR	GRNLSDFTPR	SDMEYDFLNM	DMGVFINKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQFR
229E	GRNLQDFLPR	STMEEDFLNM	DIGVFIQYK	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQVR
PEDV	GRTTADFSPR	SDMEKDFLSM	DMGLFINKYG	LEDYGFHEVV	YGDVSKTTLG	GLHLLISQVR
TGEV	GRTTFETKPR	STMEEDFLNM	DTTLFIQYK	LEDYGFHEVV	FGDVSKTTIG	GMHLLISQVR
OV43	SRVSSFTCR	TDMEKDFIAL	DQDVFIQYK	LEDYAFEHIV	YGNFNQKIIG	GLHLLIGLYR
BoCoV	SRVSSFTCR	TDMEKDFIAL	DQDVFIQYK	LEDYAFEHIV	YGNFNQKIIG	GLHLLIGLYR
MHV	SRLSSFAFPR	SEMEKDFMDL	DEDVFIKYS	LQDYAFEHVV	YGSFNQKIIG	GLHLLIGLYR
AIBV	GRSYETFEPR	SDIERDFLAM	SEESFVERYG	-KDLGLQHIL	YGEVDKPOLG	GLHTVIGMYR
SARS CoV	SRDLEDFKPR	SQMETDFLEL	AMDEFIQRK	LEGYAFEHIV	YGDFSHGQLG	GLHLMIGLAK
	6965	6975	6985	6995	7005	7015
EMCR	LSKMGVLKAD	DFVTASDRTL	RCCTVTYLNE	LSSKVCTYM	DLLDDDFVTI	LK---SLDLG
229E	LSKMGILKAE	EFVAASDRTL	KCCTVTYLND	PSSKTVCTYM	DLLDDDFVSV	LK---SLDLT
PEDV	LACMGVLKID	EFVSSNDSTL	KSCVTYADN	PSSKMVCTYM	DLLDDDFVSI	LK---SLDLN
TGEV	LAKMGLFSVQ	EFMNSDSTL	KSCCITYADD	PSSKNVCTYM	DILLDDDFVTI	IK---SLDLN
OV43	RQQTSLNLVQ	EFVS-YDSSI	HSYFITDEKS	GGSKSVCTVI	DILLDDDFVAL	VK---SLNLN
BoCoV	RQQTSLNLVQ	EFVS-YDSSI	HSYFITDEKS	GGSKSVCTVI	DILLDDDFVAL	VK---SLNLN
MHV	RQQTSLNLVQ	EFVS-YDSSI	HSYFITDEKS	GGSKSVCTVI	DILLDDDFVAL	VK---SLNLN
AIBV	LLRANKLNAK	SVTN-SDSDV	MQNYFVLSDN	GSYKQVCTVV	DLLDDDFLEL	LRNLIKKEYGT
SARS CoV	RSQDSPLKLE	DFIP-MDSTV	KNYFITDAQT	GSSKCVCSVI	DLLDDDFVEI	IK---SQDLS
	7025	7035	7045	7055	7065	7075
EMCR	VISKVHEVII	DNKPYRWMLW	CKDNHLSFTY	PQLQS-AEWK	CGYAMPQIYK	LQRMCLPCN
229E	VVSKVHEVII	DNKPYRWMLW	CKDNHLSFTY	PQLQS-AEWK	CGYSMPGIYK	TQRMCLPCN
PEDV	VVSKVHEVMV	DKMWRWMLW	CKDHKLQTFY	PQLQA-SEWK	CGYSMPGIYK	IQRMCLPCN
TGEV	VVSKVVDVIV	DKAWRWMLW	CENSHIKTFY	PQLQS-AEWN	PGYSMPPTLYK	IQRMCLPCN
OV43	CVSKVVNVNV	DFKDFQFMLW	CNDEKVMFTY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS
BoCoV	CVSKVVNVNV	DFKDFQFMLW	CNDEKVMFTY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS
MHV	CVSKVVNVNV	DFKDFQFMLW	CNDEKVMFTY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS
AIBV	NKSKVTVTSI	DYHSINFTMW	FEDGSIKTCY	PQLQS--AWT	CGYNMPELYK	VQNCVMEPCN
SARS CoV	VISKVVKVTI	DYAEISFMLW	CKDGHVETFY	PKLQASQAWQ	PGVAMPNLYK	MQRMLEKCD

	7085 7095 7105 7115 7125 7135
EMCR	LYNYGAGIKL PSGIMLNVVK YTQLCQYLNS TTMCVPHNMR VLHYGAGSDK GVAPGTTVLK
229E	LYNYGAGLKL PSGIMFNVVK YTQLCQYFNS TTLCVPHNMR VLHLGAGSDY GVAPGTAVLK
PEDV	LYNYGAGVKL PDGIMFNVVK YTQLCQYLNS TTMCVPHNMR VLHLGAGSDK GVAPGTAVLR
TGEV	LYNYGAQVKL PDGITTNNVK YTQLCQYLNT TTLCVPHKMR VLHLGAAGAS GVAPGSTVLR
OV43	LWNYGKPVTL PTGCMNVAK YTQLCQYLNT TTLAVPVNMR VLHLGAGSEK GVAPGSAVLR
BoCoV	LWNYGKPVTL PTGCMNVAK YTQLCQYLNT TTLAVPVNTR VLHLGAGSEK GVAPGSAVLR
MHV	LWNYGKPITL PTGCLMNVAK YTQLCQYLNT TTLAVPANMR VLHLGAGSDK DVAPGSAVLR
AIBV	IPNYGVGITL PSGILMNVAK YTQLCQYLSK TTICVPHNMR VMHFGAGSDK GVAPGSTVLK
SARS CoV	LQNYGENAVI PKGIMNVAK YTQLCQYLNT LTLAVPVNMR VIHFGAGSDK GVAPGTAVLR

	7145 7155 7165 7175 7185 7195
EMCR	RWLPPD-----AIII DNDINDYVSD ADFSITGDCA TVYLEDKFDL LISDMYDG--
229E	RWLPHD-----AIVV DNDVDYVSD ADFSVTGDCA TVYLEDKFDL LISDMYDG--
PEDV	RWLPLD-----AIIV DNDSDYVSD ADYSVTGDCS TLYLSDKFDL VISDMYDG--
TGEV	RWLPPD-----AILV DNDLRDYVSD ADFSVTGDCT SLYIEDKFDL LVSDLYDG--
OV43	QWLPA-----TILV DNDLYPFVSD SVATYFGDCI TLPFDCQWDL IISDMYDP--
BoCoV	QWLPA-----TILV DNDLYPFVSD SVATYFGDCI TLPFDCQWDL IISDMYDP--
MHV	QWLPA-----SILV DNDINPFVSD SVASYGNCI TLPFDCQWDL IISDMYDP--
AIBV	QWLPE-----TLLV DNDIVDYVSD AHVSVLSDCN KYNTEHKFDL VISDMYTDND
SARS CoV	QWLPT-----TLLV DNDLNDYVSD ADSTLIGDCA TVHTANKWDL IISDMYDP--

	7205 7215 7225 7235 7245 7255
EMCR	--RIKFCDGE NVSKDGFETY LNGVIREKLA IGGVAIKIT EYSWNKLYE LIQRFAFWTL
229E	--RTKAIDGE NVSKEGFETY INGFIKELA IGGVAIKIT EYSWNKKLYE LVQRFSFWTM
PEDV	--KIKSCDGE NVSKEGFETY INGVIKELA LGGTVAIKIT EFSWNKKLYE LIQKFEYWTM
TGEV	--STKSIDGE NTSKDGFFTY INGFIKELS LGGSVAIKIT EFSWNKDLYE LIQRFEYWTV
OV43	--ITKNIGEY NVSKDGFETY ICHMIRDKLA LGGSVAIKIT EFSWNAELYK LMGYFAFWTV
BoCoV	--LLLDIGVH VVRCS---YI HCHMIRDKLA LGGSVAIKIT EFSWNAELYK LMGYFAFWTV
MHV	--LTKNIGEY NVSKDGFETY LCHLIRDKLA LGGSVAIKIT EFSWNAELYS LMGKFAFWTI
AIBV	SKRKHEGVIA NNGNDDVEIY LSSFLRNNLA LGGSFAVKIT ETSWHEVLYD IAQDCAWWTM
SARS CoV	--RTKHVTKE NDSKEGFETY LCGFIKQKLA LGGSIAVKIT EHSWNADLYK LMGHFSWWTA

	7265 7275 7285 7295 7305 7315
EMCR	FCTSVNTSSS EAFLIGINYL GDFIQGPFFIA GNTVHANYIF WRNSTIMSLS YNSVLDLSKF
229E	FCTSVNTSSS EAFVVGINYL GDFAQGPFFID GNIIHANYVF WRNSTVMSLS YNSVLDLSKF
PEDV	FCTSVNTSSS EAFLIGVHYL GDFASGAVID GNTMHANYIF WRNSTIMTMS YNSVLDLSKF
TGEV	FCTSVNTSSS EGFLIGINYL GPYCDKAIVD GNIMHANYIF WRNSTIMALS HNSVLDTPKF
OV43	FCTNANASSS EGFLIGINYL CKPKV--EID GNMVHANYLF WRNSTVWNGG AYSLFDMAKF
BoCoV	FCTNANASSS EGFLIGINYL GKPKV--EID GNMVHAIICF G-----
MHV	FCTNVNASSS EGFLIGINYL NRTRT--EID GKTMHANYLF WRNSTMWNGG AYSLFDMSKF
AIBV	FCTAVNASSS EAFLIGVNYL GASEK-VKVS GKTLHANYIF WRNCNYLQTS AISIFDVAKF
SARS CoV	FVTNVNASSS EAFLIGANYL GKPKV--QID GYTMHANYIF WRNTNPIQLS SYSLFDMSKF

	7325 7335 7345 7355 7365
EMCR	ECKHKATVVV TLKDSVDNDM VLSLIKSGRL LLRNSGRFGG FSNHLVSTK-
229E	NCKHKATVVV QLKDSDINEM VLSLVRSGKL LVRGNGKCLS FSNHLVSTK-
PEDV	NCKHKATVVV NLKDSISDV VLGLLRNGKL LVRNNDACG FSNHLVNVNK
TGEV	KCRCNNALIV NLKEKELNEM VIGLLRNGKL LIRNNGKLLN FGNNHFVNTP-
OV43	PLKLAGTAVI NLRADQINDM VYSLLEKGL LIRDITNKEVF VGDSLNVNI-
BoCoV	EIPQFGTGVL IACLIWLSNR LSWLVMP--- -----
MHV	PLKVAGTAVV SLKPDQINDL VLSLIERGKL LVRDTRKEVF VGDSLNVNK-
AIBV	DLRLKATPVV NLKTEQKTDL VFNLIKCGKL LVRDVGNTSF TSDFSVCMTM-
SARS CoV	PLKLRTAVM SLKENQINDM IYSLLEKGL IIRENNRVVV SSDILVNN--

e. Putative Spike protein

	5	15	25	35	45	55
EMCR S	----MKLFLI	LLILP----L	VSCFSTC---	-----N	SNASIS----	-----ML
229E S						
PEDV	MRSLIYFWLL	LPVLP----T	LSLPQDV---	-----T	RCQSTTNF--	-----RRFFS
TGEV	---MKKLFVV	LVVMP----L	IYGDNEP---	-----C	SKLTNRTIGN	QWNLIETFLF
CaCoV	---MIVLTLC	LFLFL-YSSV	SCTSNND---	-----C	VQVNVTLQPG	NENIHKDFLF
FeCoV	---MIVLVTC	LLLLCSYHTV	LSTTNE---	-----C	IQVNVTLQAG	NENLIRDFLF
Por Resp C	---MKKLFVV	LVVMP----L	IYG-----			
OC43	-----MFLIL	LISLPTAFV	IGDLKCTSDT	SYINDKDTGP	PPISTDTVDV	TNGLGTYIVL
BoCoV	-----MFLIL	LISLPMFAV	IGDLKCT--T	VSINDVDTGA	PSISTDIVDV	TNGLGTYIVL
MHV	-----MLFVF	LTLLPSSLGY	IGDFRCIQ-L	VNTDTSNASE	PSVSTEVDV	SKGIGTYIVL
Rat CoV	-----MLFVF	LTLLPSSLGY	IGDFRCIN-L	VNTRISNARA	PSVSTEVDV	SKGLGTYIVL
PHEV	-----MFFIL	LISLPSAFV	IGDLKCT--T	SLINDVDTGV	PSISSEVDV	TNGLGTYIVL
AIBV						
SARS	---MFIFLL	FLTTLTSG--	-SDLR-----		-CTTFDDVQA	PNYTQHTSSM
	65	75	85	95	105	115
EMCR S	QLG--VPDNS	STIVTGLLP-	---VHWICAN	QSTSSYPANG	FFYIDVG-KH	RSAFALHSGY
229E S						
PEDV	KFN--VQAPA	VVVLGGYLP	MNSSSWYCGT	GIETASGVHG	IFLSYIDSGQ	GFEIGISQEP
TGEV	NYSSRLPPNS	DVVLGDYFPT	--VQWFNCI	RNDSNDLYVT	LENLKALYWD	YATENITWN-
CaCoV	QN---FKEEG	SLVVGYYYP-	--TEVWYNC	TTQQTAYKY	FSNIHAFYFD	MEAMENSTGN
FeCoV	SN---FKEEG	SVVVGYYYP-	--TEVWYNC	RTARTTAFQY	FNNIHAFFYFV	MEAMENSTGN
Por Resp C						
OC43	DR---VYLNT	TLFLNGYYPT	SGSTYRNMAL	KGSVLLSRLW	FKPPFLSDFI	NGIFAKVKNT
BoCoV	DR---VYLNT	TLLNGYYPT	SGSTYRNMAL	KGTLLSRLW	FKPPFLSDFI	NGIFAKVKNT
MHV	DR---VYLNA	TLLLTGYYPV	DGSMYRNMAL	TGINTISLW	YKPPFLSEFN	DGIFAKVKNL
Rat CoV	DR---VYLNA	TLLLTGYYPV	DGSMYRNMAL	MGTNTLSLW	FEPFLSEFN	DGIYAKVKNL
PHEV	DR---VYLNT	TLLNGYYPI	SGATFRNMAL	KGTRLLSTLW	FKPPFLSPFN	DGIFAKVKNS
AIBV						
SARS	RG---VYYPD	EIFRSDTLYL	TQDLFLPFYS	NVTGFHTINH	TFGNPVIFPK	DGIYFAATEK
	125	135	145	155	165	175
EMCR S	YDANQYIYL	TNKIH----		LNAPVTLKIC	KFGN-----	---TSDFLS
229E S						
PEDV	FDPGGYQLYL	HKATNG----	-----N	TNAIARLRIC	QFPDN-----	--KTGPTVN
TGEV	-HRQLNVVV	NGYPYSITV-	-----TTTRN	FNSAEGAIIC	ICKGSPPTTT	TESSLTCNWG
CaCoV	ARGKPLLVHV	HGNPVSIIIV	ISAYRDDVQF	RPLKHLGLLC	ITKN--DTVD	YNSFTINQWR
FeCoV	ARGKPLLFHV	HGEPVSVII-	-SAYRDDVQQ	RPLKHLGLVC	ITKN--RHIN	YEQFTSNQWN
Por Resp C						
OC43	KVIKDRVMYS	EFPAITIG--	-----STF	VNTSYSVVVQ	PRTINSTQDG	YNKLQGLLEV
BoCoV	KVIKGVVMYS	EFPAITIG--	-----STF	VNTSYSVVVQ	PHTTN----L	DNKLQGLLEI
MHV	KASLPKDSIS	YFPTIIIG--	-----SNF	VNTSYTVVLE	PYN-----	---GIIMA
Rat CoV	KASLPKDSIS	YFPTIIIG--	-----SNF	VNTSYTVVLE	PYN-----	---GIIMA
PHEV	RFSKDGVIYS	EFPAITIG--	-----STF	VNTSYSIVVE	PHTSL----I	NGNLQGLLOI
AIBV						
SARS	SNVVRGWVFG	STMNKSQS-	-----VII	INNSTNVVIR	ACN-----FEL	CDNPFFAVSK
	185	195	205	215	225	235
EMCR S	NVSTSHDCIV	NLSFTEQL--	GVPLGITISG	ETVRLHLYNA	TRTFYVPAAY	KLTKLSVKCY
229E S						
PEDV	DVTTRNCLF	NKAIPAYMRD	GKDIVVGITW	DNDRVTVF-A	--MFVLLVAY	ALLHIAG---
TGEV	SECR-LNHKF	PICPSNSEAN	CGNMLYGLQW	FADEVVAYLH	GASYRISFEN	QWSTVTFGD
CaCoV	DICLGDDRKI	PFSVVPTDN-	-GTKLFGLEW	NDDYVTAYIS	DESHRLNINN	NWFNNVTLLY
FeCoV	STCTGADRKI	PFSVIPTDN-	-GTKIYGLEW	NDDFVTAYIS	GRSYHLNINT	NWFNNVTLLY
Por Resp C	-----KF	-----P				
OC43	SVCQYNMCEY	PQTICHPNLG	--NHRKELWH	LDTGVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
BoCoV	SVCQYTMCEY	PHTICHPKLG	--NKRVELWH	WDTGVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
MHV	SICQYTTICQL	PYTDCKPNTG	G-NKLIGFWH	TELKSPVCIL	KRNFTFNVNA	EWLYFHFYQ-
Rat CoV	SICQYTTICQL	PHTDCKPNTG	G-NKLIGFWH	TDLRPPVCIL	KRNFTFNVNA	EWLYFHFYQ-
PHEV	SVCQYTMCEY	PHTICHPNLG	--NRIELWH	YDTPVVSCLY	RRNFTYDVNA	DYLYFHFYQ-
AIBV						
SARS	PMGTQHTMI	FDNAFNCTFE	YISDAFSLDV	SE-KSGNFKH	LREFVFKNKD	GFLYVYKG--

	245	255	265	275	285	295
EMCR S	FSESCVF---	-----SVVNA-	-T-ITVNVTT	LNGRIVNYTV	CDD---CNGY	TDNIFSVQQD
229E S	-----	-----CQT	TNGLNTSYSV	CNG---CVGY	SENVFVAVESG	
PEDV	NRRSCAM---	-----QYVYTP	TY-YMLNVTS	AGEDGIYYEP	CTAN--CTGY	AANVFATDSN
TGEV	MRATTLEVAG	TLVDLWWFNP	VYDVSYYRVN	NKNGTTVVSN	CTD--QCASY	VANVFETQPG
CaCoV	SRTSTATWQH	S--AAYVYQG	VSNTFYKLN	KTAGLKSYEL	CEDYEYCTGY	ATNVFAPTS
FeCoV	SRSSTATWEY	S--AAYAYQG	VSNTFYKLN	NTNGLKTYEL	CEDYEHCTGY	ATNVFAPTS
Por Resp C	-----	-----	-----	-----TSVVS	CTD--QCASY	VANVFETILPG
OC43	EGG-----	-----	-TFYAYFTDT	GVVTKFLFNV	YLG---MAL	HYVVMPLTCN
BoCoV	EGG-----	-----	-TFYAYFTDT	GVVTKFLFNV	YLG---TVLS	HYVVLPLTCS
MHV	QGG-----	-----	-TFYAYADV	SSATTFLFSM	YIG---DVL	QYFVLPYMC
Rat CoV	QGG-----	-----	-TFYAYADV	SSATTFLFS	YIG---AVLT	QYFVLPYMC
PHEV	EGG-----	-----	-TFYAYFTDT	GFVTKFLFKL	YLG---TVLS	HYVVMPLTCN
AIBV	S-----	-----	---YVYYYQS	AFRPPSGWHL	QGG---AYAV	VNISSEFNNA
SARS	YQP-----	-----	IDVVRDLPSG	FNTLKPIFKL	PLG--INITNF	RAILTAFA

	305	315	325	335	345	355
EMCR S	GRIPNGFPFN	NWFL-LTNGS	TLVDGVSRLY	QPLRLTCLWP	VPGLKSSTGF	VYFNATGSDV
229E S	GYIPSDFAFN	NWFL-LTNTS	SVVDGVVRSF	QPLLLNCLWS	VSGLRFTTGF	VYFNGTG-RG
PEDV	GHIPEGFSFN	NWFL-LSNDS	TLHGKVVSN	QPLLVNCLLA	IPKIYGLGQF	QSFNHTM-DG
TGEV	GFIPSDFSFN	NWFL-LTNSS	TLVSGKLVTK	QPLLVNCLWP	VPSFEEAAS	FCFEGAG-FD
CaCoV	GYIPDGFSFN	NWFL-LTNSS	TFVSGRFVTN	QPLLVNCLWP	VPSFGVAAQ	FCFEGAQ-FS
FeCoV	GYIPDGFSFN	NWFL-LTNSS	TFVSGRFVTN	QPLLVNCLWP	VPSFGVAAQ	FCFEGAQ-FS
Por Resp C	GFIPSDFSFN	NWFL-LTNSS	TLVSGKLVTK	QPLLVNCLWP	VPSFEEAAS	FCFEGAG-FD
OC43	SKVKNFTLE	YWVTPLTSRQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ	SIAPPTG-VY
BoCoV	S-----AMTLE	YWVTPLTSKQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ	SIAPPTG-VY
MHV	LTTTGVSFPQ	YWVTPLVKRQ	YLFNFNQKGI	ITSAVDCASS	YTSEIKCKTQ	SMNPNTG-VY
Rat CoV	PTTSGVSSPQ	YWVTPLVKRQ	YLFNFNQKGI	ITSAVDCASS	YTSEIKCKTQ	SMNPNTG-VY
PHEV	S-----ALSLE	YWVTPLTTRQ	FLAFDQDGV	LYHAVDCASD	FMSEIMCKTS	SIPTPTG-VY
AIBV	G-----SSS	GCTVGIIHGG	RUVNASSIAM	TAPSSGMAWS	SSQFCTAHCN	FSDTTVFVTH
SARS	QDIWGTSA	YFVGYLKPTT	FMLKYDENG	ITDAVDCSQN	PLAELKCSVK	SFEIDKG-IY

	365	375	385	395	405	415
EMCR S	NCGYQHNSV	ADVRYNLNL	SANSVDNLKS	GVIVFKTLQY	-DVLFYCSN-	--SS-SGVLD
229E S	DCKGFSSDVL	SDVIRYNLNF	EEN---LRR	GTILFKTSYG	-VVVFYCTN-	--NT-LVSGD
PEDV	VCNGAAVDRA	PEALRFNIND	TSV---ILAE	GSIVLHTALG	TNLSFVCSN-	--SSDPLHAI
TGEV	QCNGAVLNNT	VDVIRFNLNF	TTNVQSGKGA	TVFSLNTTGG	VTLEISCY--	TVSDSSFFSY
CaCoV	QCNGVSLNNT	VDVIRFNLNF	TTNVQSGKGA	TVFSLNTTGG	VILEISCYND	TVSESSFFSY
FeCoV	QCNGVSLNNT	VDVIRFNLNF	TADVQSGMGA	TVFSLNTTGG	VILEISCYSD	TVSESSFFSY
Por Resp C	QCNGAVLNNT	VDVIRFNLNF	TTNVQSGKGA	TVFSLNTTGG	VTLEISCYND	TVSDSSFFSY
OC43	ELNGYTVQPI	ADVYRRKLN	PNCNIEAWLN	DKSVPSPLNW	ERKTFSNCF	NMSSLMSFIQ
BoCoV	ELNGYTVQPI	ADVYRRIPNL	PDCNIEAWLN	DKSVPSPLNW	ERKTFSNCF	NMSSLMSFIQ
MHV	DLGGYTVQPV	GLVYRRVRNL	PDCNIEAWLN	AKSVPSPLNW	ERKTFQNCNF	DLSSLRFRVQ
Rat CoV	DLGGYTVQPV	GLVYRRVRNL	PDCNIEAWLN	AKSVPSPLNW	ERKTFQNCNF	DLSSLRFRVQ
PHEV	ELNGYTVQPV	ATVYRRIPDL	PNCNIEAWLN	SKTVSSPLNW	ERKIFSNCF	NMSSLMSFIQ
AIBV	CYKHGGCPLT	GMLQONLIRV	SAMKNGQLFY	NLTVSVAKYP	TFRSFQCVN-	--NLTSVLYN
SARS	QTSNFRVVP	GDVVRFPNIT	NLCPFGEVFN	ATKFPSPYAW	ERKKISNCVA	DYSVLYNSTF

	425	435	445	455	465	475
EMCR S	TTIPFGPSSQ	PYYCFINSTI	NTHVSTFVG	ILPPTVREIV	VARTGQFYIN	GFKYFDLGEI
229E S	AHIFPGTVLG	NFYCFVNTTI	GNETTSFVVG	ALPKTVREIV	ISRTGHFYIN	GYYRFTLGNV
PEDV	FAIPLGATEV	PYYCFLKVD	YNTSYVKFLA	VLPTVREIV	ITKYGDVYVN	FGGYLHLGLL
TGEV	GEIPFGVTDG	PRYCYV---H	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNEFFSTFI
CaCoV	GEIPFGVTDG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNEFFSTFI
FeCoV	GEIPFGITDG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNEFFSTFI
Por Resp C	GEIPFGVTNG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNEFFSTFI
OC43	ADSFTCNNID	AAKIYG---MC	FSSITIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIDTTATS
BoCoV	ADSFTCNNID	AAKIYG---MC	FSSITIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIDTTATS
MHV	AESLSCSNID	ASKVYG---MC	FGSISIDKFA	IPNRRRVDLQ	LGNLGYLQSF	NYRIDTTATS
Rat CoV	AESLSCSNID	ASKVYG---MC	FGSISIDKFA	IPNRRRVDLQ	LGNLGYLQSF	NYRIDTTATS
PHEV	ADSFCCNNID	ASRLYG---MC	FGSITIDKFA	IPNSRKVDLQ	VGKSGYLQSF	NYKIDTAVSS
AIBV	GDLVYTSNET	IDVTSAG---V	YFKAGGPITY	KVMREVKALA	YFVNGTAQDV	ILCDGSPRGL
SARS	FSTFKCYQVS	ATKLNLD---LC	FSNVYADSEV	VKGDDVRQIA	PGQTGVIADY	NYKLPPDDFMG

	485	495	505	515	525	535
EMCR S	EAVNFNVT--	--TASATDFW	TVAFAFVDV	LNVVSATNIQ	NLLYCDSPFE	KLQCEHLQFG
229E S	EAVNFNVT--	--TAETTDFFC	TVALASYADV	LNVVSQTSIA	NIIYCNSVIN	RLRCDQLSFD
PEDV	DAVTINFTHG	GTDDDDVSGFW	TIATSTFVDA	LIEVQGTSIQ	RILYCDPVS	QLKCSQVAFD
TGEV	DCISFNLT--	--TGSDSVFV	TIATTSYTEA	LVQVENTAIT	KVTYCNSHVN	NIKCSQITAN
CaCoV	DCIAFNLT--	--TGASGAFW	TIATTSYTEA	LVQVENTAIK	KVTYCNSHIN	NIKCSQLTAN
FeCoV	DCISFNLT--	--TGVSGAFW	TIATTSYTEA	LVQVENTAIK	NVTYCNSHIN	NIKCSQLTAN
Por Resp C	DCISFNLT--	--TGSDSVFV	TIATTSYTEA	LVQVENTAIT	NVTYCNSYVN	NIKCSQLTAN
OC43	CQLYYNLP--	---AANVSVS	RFPSTWNKR	FGFIEDSVFK	PRPAGVLTNH	DVVYAQHCFFK
BoCoV	CQLYYNLP--	---AANVSVS	RFPSTWNKR	FGFTEQEVFK	PQPVGVFTHH	DVVYAQHCFFK
MHV	CQLYYSLA--	---KNNVTVN	NHNPSSWNR	YGFND-----	-VATFGTGKH	DVAYAEACFT
Rat CoV	CQLYYSLA--	---QDNVTVI	NHNPSSWNR	YGFND-----	-VATFHSGEH	DVAYAEACFT
PHEV	CQLYYSLP--	---AANVSVT	HYPNSSWNR	YGFNN-----	-QSFGSRGLH	DAVYSQCCFN
AIBV	LACQYNTG--	---NFSDDGFY	PFTNSSLVKQ	KFIVYR-----	---ENSUNT	TCTLHNFIFH
SARS	CVLAWNTR--	-----NID	ATSTGNYNYK	YRYLR-----	---HG-----	

	545	555	565	575	585	595
EMCR S	LQDGFY--SA	--NFLDDNVL	P-----ET	YVALPIYYQH	TDINFTATA-	--SFGGSCYV
229E S	VPDGFY--ST	--SPIQSVEL	P-----VS	IVSLPVIYKH	TFIVLYVDFK	PQSGGGKCFN
PEDV	LDQGFYPISS	--RNLLSHEQ	P-----IS	FVTLPSFNDH	SFVNITVSA-	--AFGG-LSS
TGEV	LNNGFYPVSS	--SEVG--LV	N-----KS	VVLLPSFYTH	TIVNITIGLG	--MKRSGYGQP
CaCoV	LQNGFYPPAS	--SEVG--LV	N-----KS	VVLLPSFYSH	TSVNITIDLG	--MKRS-VTVT
FeCoV	LNNGFYPPAS	--SEVG--FV	N-----KS	VVLLPSFFTY	TAVNITIDLG	--MKLSGYGQP
Por Resp C	LNNGFYPVSS	--SEVG--SV	N-----KS	VVLLPSFLTH	TIVNITIGLG	--MKRSGYGQP
OC43	APKNFCPCKL	NGS-CVGS GP	G-----KNNG	IGTCPAGTNY	LTCDN-----	-----LC
BoCoV	APKNFCPCKL	DGSLCVGN GP	GIDAGYKNSG	IGTCPAGTNY	LTCHNAA----	-----QCDCLC
MHV	VGASYCPCAN	P-SIVSPCTT	G-----K-PN	FANCPGTSTN	RECTVMPLAN	--NQFKCDCTC
Rat CoV	VGASYCPCAK	P-STVYSCVT	G-----K-PK	SANCPGTSTN	RECNVQASG-	--FKSKCDCTC
PHEV	TPNTYCPCRT	--SQCIG---	G-----AG	TGTCPVGTTV	RKCFAAVTK-	--ATKCTCWC
AIBV	NETGANPNPS	-----	-----G	VQNIQTYQTK	TAQSGYYNFN	-----FSF
SARS	---KLRPFER	-----	-----D	ISNVFFSPDG	KPCTP-----	-----

	605	615	625	635	645	655
EMCR S	CKPRQVNISL	N----GNTSV	CVRTSHFSIR	YIYNRVKSGS	P-----G	DSSWHIYLKS
229E S	CYPAGVNITL	ANFNETKGPL	CVDTSHTFTK	YVAVYANVG-	-----	--RWSASINT
PEDV	ANLVASDTTI	N----GFSSE	CVDTRQFTIT	LFYNVTNSYG	-----	-----YVKSQD
TGEV	IASTLSNITL	PMQDHNIDVY	CIRSDQFSVY	VHSTCKSALW	DNIFKRNCTD	VLDATAVIKT
CaCoV	IASTLSNITL	PMQDNNIDVY	CIRSNQFSVY	VHSTCKSSLW	DNNFNSACTD	VLDATAVIKT
FeCoV	IASTLSNITL	PMQDNNIDVY	CIRSNQFSVY	VHSTCKSSLW	DNIFNQDCTD	VLEATAVIKT
Por Resp C	IASTLSNITL	PMQDNNIDVY	CVRSDQFSVY	VHSTCKSVLW	DNVFKRNCTD	VLDATAVIKT
OC43	TPDPITFKAT	GTYPKCPQTKS	LVGIGEHCSG	LAVKSDYCGG	-----N	SCTCRPQAFI
BoCoV	TPDPITSKST	GPYKCPQTKY	LVGIGEHCSG	LAIKSDYCGG	-----N	PCTCQPPAFI
MHV	NPSPLTTYDL	--R-CLQARS	MLGVGDHCEG	LGVLEDKCGG	S-----N	TCNCSAHAFV
Rat CoV	NPSPLTTYDP	--R-CLQARS	MLGVGDHCEG	LGILEDKCGG	S-----N	ICNCSADAFV
PHEV	QPDSTYKGV	NAWTCQPSKV	SIQPGQHCPC	LGLVEDDCSG	-----N	PCTCKPQAFI
AIBV	LSSFVYKESN	FMYGSYHPSC	KFRLETINNG	LWFNSLSVS-	-----	---IAYGPLQ
SARS	-----	-----P--AL	NCYWPLNDY-	-----G	-----	---FYTTTGI

	665	675	685	695	705	715
EMCR S	GTCPFSFSKL	NNFQKFKTIC	FSTVEVPGSC	NFPLEATW--	HYTSYITVGA	LYVTWSEGN
229E S	GNCPSFSGKV	NNFVKFGSVC	FSLKDIPGGC	AMPIVANW--	AYSYYTIGS	LYVSWSDGDG
PEDV	SNCPTTLQSV	NDYLSFSKFC	VSTSLLAGAC	TIDLFYGP--	AFSGSVKLT	LYFQFTKGL
TGEV	GTCPFSFDKL	NNYLTFNKFC	LSLSPVGANC	KFDVAAR---	TRTNEQVVR	LYVIEEGDN
CaCoV	GTCPFSFDKL	NNYLTFNKFC	LSLSPVGANC	KFDVAAR---	TRTNEQVVR	LYVIEEGDN
FeCoV	GTCPFSFDKL	NNYLTFNKFC	LSLSPVGANC	KFDVAAR---	TRTNEQVVR	LYVIEEGDN
Por Resp C	GTCPFSFDKL	NNYLTFNKFC	LSLSPVGANC	KFDVAAR---	TRTNEQVVR	LYVIEEGDN
OC43	GWSADSCLOQ	DKCNIFANFI	LHDVNSGLTC	STDLOKANTD	IILGVCVNYD	LYGILGQGI
BoCoV	GWSVDSCLQ	DRCNIFANFI	FHDVNSGTTT	STDLOKSNTD	IILGVCVNYD	LYGITGQGI
MHV	GWAKDSCLAN	GRCHIFSNLM	LNGINSGLTC	SMDLQLPNTE	VVTGVCVKYD	LYGITGQGI
Rat CoV	GWAMDSCLSN	ARCHIFSNLM	LNGINSGLTC	STDLOLPNTE	VVTGVCVKYD	LYGSTGQGI
PHEV	GWSSETCLQN	GRCNIFANFI	LNDVNSGTTT	STDLOQGNIT	ITTDVCVNYD	LYGITGQGI
AIBV	GGCQSVFVK	RATCCYAYS	GGPSLCKGVY	SGELDHN---	---FECGLLV	YVTKSGSRI
SARS	GYQPYRVVVL	S----FELLN	APATVCGPKL	STDLIKNN---	---QCVNFN	FNGLTGTG-V

	725	735	745	755	765	775
EMCR S	ITGVPPVPSG	IREFSNLVLN	NCTKYNIYDY	VGTGIIRSSN	QSLAGGITYV	S-----
229E S	ITGVPPVPSG	VSSFMNVTLD	KCTKYNIYDV	SGVGIVRVSN	DTFLNGITYT	S-----
PEDV	ITGTPEKPLEG	ITDVSFMTLD	VCTKYTIYGF	KGEGITLTN	SSILAGVYYT	S-----
TGEV	IVGVPSDMSG	VHDLVLHLD	SCTDYNIGR	TGVGIIRQTN	RTLLSGLYYT	S-----
CaCoV	IVGVPSDMSG	LHDLVLHLD	SCTDYNIGR	TGVGIIRQTN	RTLLSGLYYT	S-----
FeCoV	IVGVPSDMSG	LHDLVLHLD	SCTDYNIGR	TGVGIIRQTN	RTLLSGLYYT	S-----
Por Resp C	IVGVPSDMSG	LHDLVLHLD	SCTDYNIGR	TGVGIIRQTN	RTLLSGLYYT	S-----
OC43	VEVNATYYNS	WQNLLYDSNG	NLYGFRDYIT	NRTFMIRSCY	SGRVSAAFHA	N-----
BoCoV	VEVNATYYNS	WQNLLYDSNG	NLYGFRDYIT	NRTFMIRSCY	SGRVSAAFHA	N-----
MHV	KEVKADYYHS	WQNLLYDVNG	NLIGFRDFVA	NKSYTIRSCY	SGRVSAAYHQ	D-----
Rat CoV	KEVKADYYHS	WQNLLYDVNG	NLIGFRDFIVT	NKTYLLRSCY	SGRVSAAYHQ	D-----
PHEV	IEVNATYYNS	WQNLLYDSSG	NLYGFRDYLS	NRTFLIRSCY	SGRVSAVFHA	N-----
AIBV	QTATEPPVIT	QNNYNNITLN	TCVDYNIYGR	TGQGFITNVT	DSAVSYNYLA	DAGLAILDTS
SARS	LTPSSKRFPQ	FQQFGRDVSD	FTDSVRDPKT	SEILDISPSC	FGGVSIVITPG	TN-----A

	785	795	805	815	825	835
EMCR S	NSGNLLGFKN	VSTGNIFIVT	PCNQPDQVAV	YQQ-SIIGAM	TAVNESRYGL	QNLLQLPNFY
229E S	TSGNLLGFKD	VTGKIYISVT	PCNPPDQLVV	YQQ-AVVGAM	LSNFTSYGF	NNVVELPKFF
PEDV	DSGQLLAFKN	VTSGAVYSIT	PCSFSEQAAY	VND-DIVGVI	SSLNS--TF	NNTRELPGF
TGEV	LSGDLGFKN	VSDGVIYSVT	PCDVSAQAAV	IDG-TIVGAI	TSINSELLGL	THWTTTPNFY
CaCoV	LSGDLGFKN	VSDGVVYSVT	PCDVSAQAAV	IDG-AIVGAM	TSINSELLGL	THWTTTPNFY
FeCoV	LSGDLGFKN	VSDGVIYSVT	PCDVSAQAAV	IDG-AIVGAM	TSINSELLGL	THWTTTPNFY
Por Resp C	LSGDLGFTN	VSDGVIYSVT	PCDVSAQAAI	IDG-TIVGAI	TSINSELLGL	THWTTTPNFY
OC43	SSEPALLFRN	IKCNVFNNS	LTRQLQPINY	FDS-YLGCVV	NAYNSTAISV	QTCDLTVGSG
BoCoV	SSEPALLFRN	IKCNVFNNS	LSRQLQPINY	FDS-YLGCVV	NADNSTSSV	QTCDLTVGSG
MHV	APEPALLYRN	LKCDYVFNNN	ISREETPLNY	FDS-YLGCVV	NADNSTEEAV	DACDLRMGSG
Rat CoV	APEPALLYRN	LKCDYVFNNN	ISREETPLNY	FDS-YLGCVI	NADNSTEQSV	DACDLRMGSG
PHEV	SSEPALLFRN	LKSHVFNNT	ILRQLQVNY	FDS-YLGCVV	NAYNNTASAV	STCDLTVGSG
AIBV	GSIDIFVQQ	EYGLNYYKVN	PCEDVNQQFV	VSGGKLVGIL	TSRNETGSQ	LENQFYIKIT
SARS	SSEAVLYQD	VNCTDVSTAI	HADQLTPAWR	IYS-TGNNVF	QTQAGCLIGA	EHVDTSYEC

	845	855	865	875	885	895
EMCR S	YVS-----NG	GNN-----	-----CTTAV	MIYSNFGICA	DGSLIPVRPR	NSSDNGISAI
229E S	YAS-----NG	TYN-----	-----CTDAV	LTYSFSGVCA	DGSIIVAVQPR	NVSYDSVSIAI
PEDV	YHS-----ND	GSN-----	-----CTEPV	LVYSNIGVCK	SGSIGYV-PS	QYQGVKIAPT
TGEV	YYSI---YNY	TNDRTRGTAI	DSNDVDCEPV	ITYSNIGVCK	NGAFVFIN-V	THSDGDVQPI
CaCoV	YYSI---YNY	TNVMNRGTAI	D-NDIDCEPI	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
FeCoV	YYSI---YNY	TSERTRGTAI	DSNDVDCEPV	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
Por Resp C	YYSI---YNY	TNDKTRGTPI	GSNDVDCEPV	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
OC43	YCVD---YSK	NRR-----	-----SRGAI	TTGYRFTNFE	PFTVNSVN--	---DSLEPVG
BoCoV	YCVD---YST	KRR-----	-----SRRAI	TTGYRFTNFE	PFTVNSVN--	---DSLEPVG
MHV	LCVN---YST	SHR-----	-----ARSSV	STGYKLTTFE	PFTVRIVN--	---DSVESVD
Rat CoV	LCVN---YSI	AHR-----	-----ARRSV	STGYKLTTFE	PFTVSIVN--	---DSVESVG
PHEV	YCVD---YVT	ALR-----	-----SRRSF	TTGYRFTNFE	PFAANLVN--	---DSIEPVG
AIBV	NGTRRFRRSI	TEN-----	-----VANCPY	VSYGKFCIKP	DGSIATIVPK	QLEQFVAPLF
SARS	IPIG---AGI	CAS-----	-----YHTVSL	LRSTSQKSIV	AYTMSLG---	---ADSSIAY

	905	915	925	935	945	955
EMCR S	-ITANLSIPS	NWTTSVQVEY	LQITSTPIVV	DCATYVCNGN	PRCKNLLKQY	TSACKTIEDA
229E S	-VTANLSIPS	NWTTSVQVEY	LQITSTPIVV	DCSTYVCNGN	VRCVELLKQY	TSACKTIEDA
PEDV	-VTGNISIPT	NFSMSIRTEY	LQLYNTPVSV	DCATYVCNGN	SRCKQLLTQY	TAACKTIESA
TGEV	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCSRYVCNGN	PRCNKLLTQY	VSACQTIEQA
CaCoV	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCARYVCNGN	PRCNKLLTQY	VSACQTIEQA
FeCoV	-STGNVTIPT	NFTISVQVEY	MQVYTPVSI	DCARYVCNGN	PRCNKLLTQY	VSACQTIEQA
Por Resp C	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCSRYVCNGN	PRCNKLLTQY	VSACQTIEQA
OC43	-GLYEIQIPS	EFTIGNMEEF	IQTSSPKVTI	DCAAFVCGDY	AACKSQLVEY	GSFCDNINAI
BoCoV	-GLYEIQIPS	EFTIGNMEEF	IQTSSPKVTI	DCSAFVCGDY	AACKSQLVEY	GSFCDNINAI
MHV	-GLYELQIPT	NFTIASHQEF	VQTRSPKVTI	DCAAFVCGGH	TACRQQLVEY	GSFCDNINAI
Rat CoV	-GLYEMQIPT	NFTIASHQEF	IQTRSPKVTI	DCAAFVCGDY	TACRQQLVDY	GSFCDNINAI
PHEV	-GLYEIQIPS	EFTIGNLEEF	IQTRSPKVTI	DCATFVCGDY	AACRQQLAEY	GSFCENINAI
AIBV	NVTENVLIPI	SFNLTVTDEY	IQTRMDKVQI	NCLQYVCGSS	LDCKRKLFOQY	GPVCDNILSV
SARS	-SNNTIAIPT	NFSISITTEV	MPVSMAKTSV	DCNMYICGDS	TECANLLLOQY	GSFCTQLNRA

	965	975	985	995	1005	1015
EMCR S	LRLSAHLETN	DVSSMLTFDS	NA-FSLANVT	SFG-----D	YNLSSVLPQ-	-----
229E S	LRNSARLESA	DVSEMLTFDK	KA-FTLANVS	SFG-----D	YNLSSVIPS-	-----
PEDV	LQLSARLESV	EVNSMLTISE	EA-LQLATIS	SFNG----DG	YNFTNVLGAS	-----
TGEV	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----SS	ETLDPIYKEW	PNIGGSWLEG
CaCoV	LAMGARLENM	EIDSMFLVSE	NA-LKLASVE	AFN-----ST	ENLDPIYKEW	PNIGGSWLGG
FeCoV	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----ST	ENLDPIYKEW	PSIGGSWLGG
Por Resp C	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----SS	ETLDPIYKEW	PNIGGSWLEG
OC43	LTEVNELLDT	TQLQVANSML	NG-VTLSTKL	KDGVNFNVDD	INFSPVLGCL	G-----
BoCoV	LTEVNELLDT	TQLQVANSML	NG-VTLSTKL	KDGVNFNVDD	INFSPVLGCL	G-----
MHV	LGEVNNLIDT	MQLQVASALI	QG-VTLSSRL	SDGIGGQIDD	INFSPLLGCL	G-----
Rat CoV	LGEVNNLIDT	MQLQVASALI	QG-VTLSSRL	ADGISGQIDD	INFSPLLGCL	G-----
PHEV	LTEVNELLDT	TQLQVANSML	NG-VTLSTKI	KDGINFNVDD	INFSPVLGCL	G-----
AIBV	VNSVGQKEDM	ELLNFYSSTK	PAGFNTPVLS	NVSTG-----E	FNISLLLTN-	-----
SARS	LSGIAAEQDR	NTRREVFAQVK	QM-YKTPTLK	YFG-----G	FNFSQILPDP	-----

	1025	1035	1045	1055	1065	1075
EMCR S	----RNIHSS	RIAGRSAIED	LLFSKVVTSG	LGTVDVDYKS	CTKGLS--IA	DLACAQYYNG
229E S	----LPTSGS	RVAGRSAIED	ILFSKLVTS	LGTVDADYKK	CTKGLS--IA	DLACAQYYNG
PEDV	V---YDPASGR	VVQKRSVIED	LLFNKVVTNG	LGTVDDEDYKR	CSNGRS--VA	DLVCAQYYSG
TGEV	LKYILPSHNS	KRKYSRAIED	LLFDKVVTS	LGTVDDEDYKR	CTGGYD--IA	DLVCAQYYNG
CaCoV	LKDILPSHNS	KRKYSRAIED	LLFDKVVTS	LGTVDDEDYKR	SAGGYD--IA	DLVCARYYNG
FeCoV	LKDILPSHNS	KRKYSRAIED	LLFDKVVTS	LGTVDDEDYKR	CTGGYD--IA	DLVCAQYYNG
Por Resp C	LKYILPSDNS	KRKYSRAIED	LLFSKVVTSG	LGTVDDEDYKR	CTGGYD--IA	DLVCAQYYNG
OC43	-SECSKASS-	----RSAIED	LLFDKVKLS	VG-FVEAYNN	CTGGAE--IR	DLICVQSYNG
BoCoV	-SACNKVSS-	----RSAIED	LLFSKVKLS	VG-FVEAYNN	CTGGAE--IR	DLICVQSYNG
MHV	-SDCGEVTMA	AQTGRSAIED	VLFDKVKLS	VG-FVEAYNN	CTGGQE--VR	DLICVQSFNG
Rat CoV	-SDCSEGTKA	AQ-GRSAIED	VLFDKVKLS	VG-FVESYNN	CTGGQE--VR	DLICVQSFNG
PHEV	-SECNRAST-	----RSAIED	LLFDKVKLS	VG-FVQAYNN	CTGGAE--IR	DLICVQSYNG
AIBV	-----PSSRR	K---RSLIED	LLFTSVESVG	LP-TNDAYKN	CTAGPLGFFK	DLACAREYNG
SARS	-----LKPTK-	----RSFIED	LLFNKVTIAD	AG-FMKQYGE	CLGDIN--AR	DLICAQKFNG

	1085	1095	1105	1115	1125	1135
EMCR S	IMVLPGVADA	ERMAMYTGS	IGGMVLGGLT	S----AAAI	FSLALQARLN	YVALQTDVLQ
229E S	IMVLPGVADA	ERMAMYTGS	IGGIALGGLT	S----AVSIP	FSLAIQARLN	YVALQTDVLQ
PEDV	VMVLPGVVDA	EKLHMYASL	IGGMALGGIT	A----AAALP	FSYAVQARLN	YVALQTDVLQ
TGEV	IMVLPGVANA	DKMTMYTAS	AGGITLGALG	GG---AVAIP	FAVAVQARLN	YVALQTDVLN
CaCoV	IMVLPGVAND	DKMTMYTAS	AGGITLGALS	GG---AVAIP	FAVAVQARLN	YVALQTDVLN
FeCoV	IMVLPGVANA	DKMTMYTAS	AGGITLGALG	GG---AVAIP	FAVAVQARLN	YVALQTDVLN
Por Resp C	IMVLPGVANA	DKMTMYTAS	AGGITLGALG	GG---AVAIP	FAVAVQARLN	YVALQTDVLN
OC43	IKVLPPLLSE	NQISGYTLAA	TSASLFPLWT	A----AAGVP	FYLNQYRIN	GLGVTMDVLS
BoCoV	IKVLPPLLSE	NQISGYTLAA	TSASLFPLS	A----AVGVP	FYLNQYRIN	GLGVTMDVLS
MHV	IKVLPVPLSE	NQISGYTAGA	TVSAMFP-WS	A----AAGVP	FSLSVQYRIN	GLGVTMNVLS
Rat CoV	IKVLPVPLSE	NQISGYTAGA	TASAMFPPWS	A----AAGVP	FALSVQYRIN	GLGVTMNVLS
PHEV	IKVLPPLLSE	NQISGYTLAA	TASLFPPWT	A----AAGVP	FYLNQYRIN	GLGVTMDVLS
AIBV	LLVLPPIITA	EMQALYTSSL	VASMAFGGIT	A----AGAIP	FATQLQARIN	HLGITQSLLL
SARS	LTVLPPLLTD	DMIAAYTAAL	VSGTATAGWT	FGAGALQIP	FAMQMAYRFN	GIGVTQNVLY

	1145	1155	1165	1175	1185	1195
EMCR S	ENQKILAAAF	NKAINNIVAS	FSSVNDIAITH	TAEAIHTVTI	ALNKIQDVVN	QQGSALNHLT
229E S	ENQKILAAAF	NKAMTNIVDA	FTGVNDIAITQ	TSQALQTVAT	ALNKIQDVVN	QQGNSLNHLT
PEDV	RNQQLLAESF	NSAIGNITSA	FESVKEAISQ	TSKGLNTVAH	ALTQVQEVVN	SOQSALNQLT
TGEV	KNQQILASAF	NQAIGNITQS	FGKVNDIAIHQ	TSRGLATVAK	ALAKVQDVVN	IQGQALSHLT
CaCoV	KNQQILANAF	NQAIGNITQA	FGKVNDIAIHQ	TSKGLATVAK	ALAKVQDVVN	TQGQALSHLT
FeCoV	KNQQILANAF	NQAIGNITQA	FGKVNDIAIHQ	TSQGLATVAK	ALAKVQDVVN	TQGQALSHLT
Por Resp C	KNQQILASAF	NQAIGNITQS	FGKVNDIAIHQ	TSRGLTTVAK	ALAKVQDVVN	TQGQALRHLT
OC43	QNQKLIANAF	NNALYAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
BoCoV	QNQKLIANAF	NNALDAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
MHV	ENQKMIASAF	NNAIGAIQEG	FDATN-----	-----S	ALAKMQFVVN	ANAEALNNLL
Rat CoV	ENQKMIASAF	NNAIGAIQEG	FDATN-----	-----S	ALAKIQSVVN	ANAEALNNLL
PHEV	QNQKLIASAF	NNALDAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
AIBV	KNQEKIAASF	NKAIGHMQEG	FRSTS-----	-----L	ALQIQDVVS	QQSAILTETM
SARS	ENQKQIANQF	NKAISQIQES	LTSTS-----	-----T	ALGKLQDVVN	QNAQALNTLV

	1205	1215	1225	1235	1245	1255
EMCR S	SQLRHNFQAI	SNSIHAIYDR	LDSIQADQVQ	DRLITGRLAA	LNAFVSQVLN	KYTEVRGSRR
229E S	SQLRHNFQAI	SSSIQAIYDR	LDTIQADQVQ	DRLITGRLAA	LNVFVSHLT	KYTEVRASRQ
PEDV	VQLQHNFQAI	SSSIDDIYSR	LDILSADVQV	DRLITGRLSA	LNAFVAQTLT	KYTEVQASRK
TGEV	VQLQHNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLTA	LNAFVSQTLT	RQAEVRASRQ
CaCoV	VQLQHNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLTA	LNAFVSQTLT	RQAEVRASRQ
FeCoV	VQLQHNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLTA	LNAFVSQTLT	RQAEVRASRQ
Por Resp C	VQLQHNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLTA	LNAFVSQTLT	RQAEVRASRQ
OC43	QQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSQQLS	DSTLVKFSAA
BoCoV	QQLSNRFGAI	SSSLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSQQLS	DSTLVKFSAA
MHV	NQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSKQLS	DMTLVKVSAA
Rat CoV	NQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSKQLS	DMTLVKVSAA
PHEV	QQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSQQLS	DSTLVKFSAA
AIBV	ASLNKNFGAI	SSVIQEIYQQ	FDAIQANAQV	DRLITGRLSS	LSVLASAKQA	EYIRVSQORE
SARS	QQLSSNFGAI	SSVLNDILSR	LDKVEAEVQI	DRLITGRLQS	LQTYVTQQLI	RAAEIRASAN

	1265	1275	1285	1295	1305	1315
EMCR S	LAQQKINECV	KSQSNRYGFC	G-NGTHIFSI	VNSAPDGLLF	LHTVLLPTDY	KNVKAWSGIC
229E S	LAQQKINECV	KSQSKRYGFC	G-NGTHIFSI	VNAAPEGLVF	LHTVLLPTQY	KDVEAWSGLC
PEDV	LAQQKINECV	KSQSQRFGFC	GGDGEHIFSL	VQAAPQGLLF	LHTVLPVGF	VNVLAIAGLC
TGEV	LAKDKVNECV	RSQSQRFGFC	G-NGTHLFSL	ANAAPNGMIF	FHTVLLPTAY	ETVTAWPGIC
CaCoV	LAKDKVNECV	RSQSQRFGFC	G-NGTHLFSL	ANAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
FeCoV	LAKDKVNECV	RSQSQRFGFC	G-NGTHLFSL	ANAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
Por Resp C	LAKDKVNECV	RSQSQRFGFC	G-NGTHLFSL	ANAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
OC43	QAMEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTKY	VTARVSPGLC
BoCoV	QAMEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTKY	VTAKVSPGLC
MHV	QAIEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTSF	TTANVSPGLC
Rat CoV	QAIEKVNECV	KSQSPRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTSF	TTVNVSPGLC
PHEV	QAIEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTKY	VTAKVSPGLC
AIBV	LATQKINECV	KSQSIRYSFC	G-NGRHVLT	PQNAPNGIVF	IHFSYTPDSF	VNVTAIVGFC
SARS	LAATKMSECV	LGQSKRVDFC	G-KGYHLMSE	PQAAPHGVVF	LHVTVVPSQE	RNFTTAPAI

	1325	1335	1345	1355	1365	1375
EMCR S	VDG-----IYG	YVLRQPNLVL	YS-----DN	GVFRVTSRVM	FQPRLPVLSD	FVQIYNCNVT
229E S	VDG-----TNG	YVLRQPNLAL	YK-----EG	NYRITSRIM	FEPRIPTMAD	FVQIENCNVT
PEDV	VNG-----EIA	LTLREPGLVL	FTHLQTYTA	TEYFVSSRRM	FEPKPTVSD	FVQIESCVVT
TGEV	ASDG-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
CaCoV	ASDG-SRTFG	LVEDVDQLTL	FRN-----LD	EKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
FeCoV	ASDG-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
Por Resp C	ALDV-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
OC43	IGD-----DRG	IAPKSGYFVN	VN-----	NTWMTGSGY	YYPEPITENN	VVMSTCAVN
BoCoV	IAG-----DRG	IAPKSGYFVN	VN-----	NTWMTGSGY	YYPEPITGNN	VVMSTCAVN
MHV	ISG-----DRG	LAPKAGYFVQ	DD-----	GEWKFTGSNY	YYPEPITDKN	SVMSSCAVN
Rat CoV	ISG-----DRG	LAPKAGYFVQ	DD-----	GEWKFTGSNY	YYPEPITDKN	SVMSSCAVN
PHEV	IAG-----DIG	ISPKSGYFIN	VN-----	NSWMTGSSY	YYPEPITQNN	VVMSTCAVN
AIBV	VKPNASQYA	IVPANGRGIF	IQVN-----	GSYYITARDM	YMPRAITAGD	VVTLTSCQAN
SARS	HEG-----KA	YFPREGVVFV	NG-----	TSWFITQRNF	FSPQIITTDN	TFVSGNCDVV

	1385	1395	1405	1415	1425	1435
EMCR S	FVNISRVELH	TVIP-DYVDV	NKTLQEFQAN	L-PKYVKPNF	DLTPFNLTYL	NLSSELKQLE
229E S	FVNISRSELQ	TIVP-EYIDV	NKTLQELSYK	L-PNYTVPDL	VVEQYNQTL	NLTSEISTLE
PEDV	YVNLTSQQLP	DVIP-DYIDV	NKTLDEILAS	L-PNRTGPSL	PLDVFNATYL	NLTGEIADLE
TGEV	FVNATVSDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TFDIFNATYL	NLTGEIDDL
CaCoV	FVNGTVIELP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	PLDIFHATYL	NLTGEINDLE
FeCoV	FVNATVIDLP	SIIP-DYIDI	NQTVQDILEN	YRPNWTVPEF	TLDFIFNATYL	NLTGEIDDL
Por Resp C	FVNTTVSDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TLDFVFNATYL	NLTGEIDDL
OC43	YTKAPVVMLN	TSIP-NLPDF	KEELDQWFKN	QTSVAPDLSL	DY--INVTF	DLQVEMN---
BoCoV	YTKAPDVMLN	ISTP-NLHDF	KEELDQWFKN	QTSVAPDLSL	DY--INVTF	DLQDEM---
MHV	YTKAPEVFLN	TSIP-NLPDF	KEELDQWFKN	QTSIAPDLSL	DFEKLNVTF	DLTDEM---
Rat CoV	YTKAPEVFLN	TSIT-NLPDF	KEELDQWFKN	QTSIVPDLSF	DIGKLVNFTL	DLSEYM---
PHEV	YTKAPDLMLN	TSTP-NLPDF	KEELYQWFKN	QSSVAPDLSL	DY--INVTF	DLQDEM---
AIBV	YVSVNKTUIT	TFVNDNDFDF	NDELKWWND	T--KHELPDF	DKFNYTVPIL	DIDSEID---
SARS	IGIINNVTYD	PLQP-ELDSF	KEELDQYFKN	HTSPDVLGD	ISG-INASVV	NIQKEID---

	1445	1455	1465	1475	1485	1495
EMCR S	AKTASLFSQTT	VELQGLIDQI	NSTYVDLKL	NRFENYIKWP	WWVWLIISVV	FVVLLSLLVF
229E S	NKSAELNYTV	QKLQTLIDNI	NSTLVDLKWL	NRVETIYKWP	WWVWLCISVV	LIFVVSMLLL
PEDV	QRSESLRNTT	EELRSLINNI	NNTLVLDLEWL	NRVETIYKWP	WWVWLIIVIV	LIFVVSLLVF
TGEV	FRSEKLHNTT	VELAILIDNI	NNTLVNLEWL	NRIETYVKWP	WYVWLLIGLV	VIFCIPLLLF
CaCoV	FRSEKLHNTT	VELAILIDNI	NNTLVNLEWL	NRIETYVKWP	WYVWLLIGLV	VIFCIPLLLF
FeCoV	FRSEKLHNTT	VELAILIDNI	NNTLVNLEWL	NRIETYVKWP	WYVWLLIGLV	VIFCIPLLLF
Por Resp C	FRSEKLHNTT	VELAILIDNI	NNTLVNLEWL	NRIETYVKWP	WYVWLLIGLV	VIFCIPLLLF
OC43	-----	-RLQEAIKVL	NQSYINLKDI	GTYEYVVKWP	WYVWLLICLA	GVAMLVLLFF
BoCoV	-----	-RLQEAIKVL	NQSYINLKDI	GTYEYVVKWP	WYVWLLIGFA	GVAMLVLLFF
MHV	-----	-RIQDAIKKL	NESYINLKDV	GTYEMYVKWP	WYVWLLIGLA	GVAVCVLLFF
Rat CoV	-----	-RIQDAIKNL	NESYINLKEI	GTYEMYVKWP	WYVWLLIGLA	GVAVCVLLFF
PHEV	-----	-RLQEAIKVL	NQSYINLKDI	GTYEYVVKWP	WYVWLLIGLA	GVAMLVLLFF
AIBV	-----	-RIQGVIOGL	NDSLIDLEKL	SILKTYIKWP	WYVWLAIAFA	TIIFILILGW
SARS	-----	-RLNEVAKNL	NESLIDLQEL	GKYEYQIKWP	WYVWLGFIAG	LIAIVMVTIL

	1505	1515	1525	1535	1545
EMCR S	CCLSTGCCGC	CNCLTSSMRG	CCDCGSTKLP	YYEFEKVHVQ	-----
229E S	CCCSTGCCGF	FSCFASSIRG	CCES--TKLP	YYDVEKIHQ	-----
PEDV	CCISTGCCGC	CGCCGACFSG	CCRG--PRLQ	YEAFEKVHVQ	-----
TGEV	CCCSTGCCGC	IGCLGSCCHS	ICSR--RQFEN	YEPIEKVHVH	-----
CaCoV	CCCSTGCCGC	IGCLGSCCHS	ICSR--GQFES	YEPIEKVHVH	-----
FeCoV	CCFSTGCCGC	IGCLGSCCHS	ICSR--RQFEN	YEPIEKVHVH	-----
Por Resp C	CCCSTGCCGC	IGCLGSCCHS	IFSR--RQFEN	YEPIEKVHVH	-----
OC43	ICCCGTG-CG-	-TSCFKKCGG	CCDDYTGYQE	LVIKT---SH	DD-----
BoCoV	ICCCGTG-CG-	-TSCFKICGG	CCDDYTGHQE	LVIKT---SH	DD-----
MHV	ICCCGTG-CG-	-SCCFKKCGN	CCDECGGHQD	SIVIHNISSH	ED-----
Rat CoV	ICCCGTG-CG-	-SCCFKKCGN	CCDEYGGROA	GIVIHNISSH	ED-----
PHEV	ICCCGTG-CG-	-TSCFKKCGG	CCDDYTGHQE	FVIKT---SH	DD-----
AIBV	VFFMTGCCGC	CCGCGGIMPL	MSKCGKSSY	YTTFDNDVVT	EQYRPKKS
SARS	LCCMTSCCS-	-CLKGACSCG	SCKCFDEDD	EPVLKGVKLH	YT-----

f. Putative Orf 4a

	5	15	25	35	45	55
EMCR 4a	MPFGGLFQLT	LESTINKSVA	NLKLPPHDVT	VLRDNLKPVT	TLSTITAYLL	VSLFVITYFAL
229E 4a	MALG-LFTLQ	LVSAVNQSL	NAKVASAEVSR	QVIQDVKDGT	VTFNLLAYTL	MSLFVVYFAL

	65	75	85	95	105	115
EMCR 4a	FKPLTARGRV	ACFVLKLLTL	SVYVPLLVL	GMYLDSFIIF	FLRCCFDSYM	LAIMPISNKN
229E 4a	FKARSHRGRA	ALIVFKILIL	FVYVPLLYWS	QAYIYATLIA	VILLG-RFFH	TAWHCWLYKT

	125	135	145	155	165	175
EMCR 4a	FSFVLFNVT	LCFVSGKCWY	LEQSFYENRF	AAIYGGDHYV	VLGGETITFV	SFDDLYVAIR
229E 4a	WDFIVFNVT	LCYAR-----	-----	-----	-----	-----

	185	195	205	215	225
EMCR 4a	GSCEKNLQLM	RKVDLYNGAV	IYIFAEPEPV	GIVYSSQLYE	DVPSIN
229E 4a	-----	-----	-----	-----	-----

g. Putative Orf 4ab

	5	15	25	35	45	55
EMCR 4a	MPFGGLFQLT	LESTINKSVA	NLKLPPHDVT	VLRDNLKPV	TLSTITAYLL	VSLFVTFYFAL
229E 4a	MALG-LFTLQ	LVSQVNSLS	NAKVSAEVS	QVIQDVKDGT	VTFNLLAYTL	MSLFVVYFAL
229E 4b	-----	-----	-----	-----	-----	-----

	65	75	85	95	105	115
EMCR 4a	FKPLTARGRV	ACFVLKLLTL	SVYVPLLVLF	GMYLDSFIIF	FLRCCFDSYM	LAIMPISNKN
229E 4a	FKARSHRGRA	ALIVFKILIL	FVYVPLLYWS	QAYIYATLIA	VILLG-RFFH	TAWHCWLYKT
229E 4b	-----	-----	-----	-----	-----	-----

	125	135	145	155	165	175
EMCR 4a	FSEVLEFNVTK	LCFVSGKWCWY	LEQSFYENRF	AAIYGGDHYV	VLGGETITFV	SFDDLYVAIR
229E 4a	WDFIVFNVTT	LCYAR-----	-----	-----	-----	-----
229E 4b	-----	----MQGKCW	FLENKALKPF	VCFYGGDQFL	YIGDRIVSYF	STNDLYVALR

	185	195	205	215	225	
EMCR 4a	GSCEKNLQLM	RKVDLYNGAV	IYIFAEPEPV	GIVYSSQLYE	DVPSIN	
229E 4a	-----	-----	-----	-----	-----	
229E 4b	GRIDKDLSLS	RKVELYNGEC	VYLFCEHPAV	GIVNTDFKLE	IH....	

h. Putative Orf E

	5	15	25	35	45	55
EMCR E	----MFLRLI	DDNG-IVLNS	ILWLLVMIFF	F-VLAMTFIK	LIQLCFTCHY	FFSRTLYQP-
229E	----MFLKL	DDHA-LVVNV	LLWCVVLI	L-LVCITIIK	LIKLCFTCHM	FCNRTVYGP-
PEDV	----MLQLV	NDNG-LVVNV	ILWLFVLF	L-IISITFVQ	LVNLCFTCHR	LCNSAVYTP-
TGEV	MTFPRALT	DDNG-MVINI	IFWFLIIIL	I-LLSIALLN	IIKLCMVCCN	LGRTVIIVP-
CaCoV	MTFPRALT	DDNG-MVISI	IFWFLIIIL	I-LFSIALLN	IIKLCMVCCN	LGRTVIIVP-
FeCoV	MTFPRAFT	DDHG-MVSV	FFWLLIIIL	I-LFSIALLN	VIKLCMVCCN	LGKTIIVLP-
Por Resp C	MTFPRALT	DDNG-MVISI	IFWFLIIIL	I-LLSIALLN	IIKLCMVCCN	LGRTVIIVP-
OC43	--MFADAYL	ADTV-WYVGQ	IIFIVAICLL	VTIVVVAFLA	TFKLCIQLCG	MCNTLVLS-
BoCoV	--MFADAYF	ADTV-WYVGQ	IIFIVAICLL	VIIIVVAFLA	TFKLCIQLCG	MCNTLVLS-
PHEV	--MFADAYL	ADTV-WYVGQ	IIFIVAICLL	VIIIVVAFLA	TFKLCIQLCG	MCNTLVLS-
MHV	----MFNLFL	TDTV-WYVGQ	IIFIVAVCLM	VTIIVVAFLA	SIKLCIQLCG	LCNTLLLS-
Rat CoV	----MFNLFL	IDTV-WYVGQ	IIFIVAVCLM	VTIIVVAFLA	SIKLCIQLCG	LCNTLLLS-
AIBV	--MNLNKS	EENG-SFLTA	LYIIVGFLAL	Y-LLGRALQA	FVQAADACCL	FWYTWVVIPG
SARS	----MYSFVS	EETGTLIVNS	VLLFLAFVVF	L-LVTLAILT	ALRLCAYCCN	IVNVSLVKP-

	65	75	85	95	105	
EMCR E	---VYKIFL-	-----	---AYQDYM	--QIAPV-PA	EVLNV----	--
229E	---IKNVYH-	-----	---IYQSYM	--HIDPF-PK	RVIDF----	--
PEDV	---IGRLYR-	-----	---VYKSYM	--RIDPL-PS	TVIDV----	--
TGEV	---AQHAYD-	-----	---AYKNFM	--RIKAYNPD	GALLA----	--
CaCoV	---ARHAYD-	-----	---AYKNFM	--QIRAYNPD	EALLV----	--
FeCoV	---ARHAYD-	-----	---AYKTFM	--QTKAYNPD	EAFV-----	--
Por Resp C	---VQHAYD-	-----	---AYKNFM	--RIKAYNPD	GALLV----	--
OC43	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV----	--
BoCoV	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV----	--
PHEV	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV----	--
MHV	---SICVYNR	SK-----	---QLYKYNN	E-EVRPP-PL	EVDDIIQTL	--
Rat CoV	---SIYVYNR	SK-----	---QLYKYNN	E-EVRPP-PL	EVDDIIQTL	--
AIBV	AKGTAFVYKY	TYGRKLNNPE	LEAVIVNEFP	KNGWNNKNPA	NFQDAQRDKL	YS
SARS	---TVYVYS-	-----	---RVKNLN	--SSEGV-PD	LLV-----	--

i. Putative Orf M (Matrix protein)

	5	15	25	35	45	55
EMCR	-----	-----	-----	-----	-----	M SNSS-----
229E	-----	-----	-----	-----	-----	M SNDN-----
PEDV	-----	-----	-----	-----	-----	M SNGS-----
TGEV	-----	-----	-----MK	ILLILACVIA	CACGERYCAM	KSDTDLSCRN
CaCoV	-----	-----	-----MKK	ILFLLACAIA	CVYGERYCAM	TESS-TSCRN
FeCoV	MHMMPIRPLC	KPRHIIPTKH	FWFELNKMKY	ILLILACIIA	CVYGERYCAM	QDSG-LQCIN
PRCoV	-----	-----	-----MK	ILLILACAIA	CTCGERYCAM	KDDTGLSCRN
OC43	-----	-----	-----	-----	-----	M SSKT-----
PHEV	-----	-----	-----	-----	-----	M SSPT-----
BoCoV	-----	-----	-----	-----	-----	M SSVT-----
MHV	-----	-----	-----	-----	-----	M TSTTQ-----
RatSAV	-----	-----	-----	-----	-----	M SSTTP-----
AIBV	-----	-----	-----	-----	-----	M PNETN-----
SARS	-----	-----	-----	-----	-----	M ADNG-----
	65	75	85	95	105	115
EMCR	-----V	PLSEVYVHLR	NWNFSWNLIL	TVFIVVLQYG	HYKYSRLLYG	LKMSVLWCLW
229E	-----C	-TGDIVTHLK	NWNFGWNVIL	TIFIVILQFG	HYKYSRLFYG	LKMLVLWLLW
PEDV	-----I	PVDEVIEHLR	NWNFTWNIL	TILLVVLQYG	HYKYSVFLYG	VKMAILWILW
TGEV	STASDCESCF	NGGDLIWHLA	NWNFSWSIIL	IVFITVLQYG	RPQFSWFVYG	IKMLIMWLLW
CaCoV	STAGNCASCF	ETGDLIWHLA	NWNFSWSVIL	IIFITVLQYG	RPQFSWFVCG	IKMLIMWLLW
FeCoV	GTNSRCQTCF	ERGDLIWHLA	NWNFSWSVIL	IVFITVLQYG	RPQFSWLQYG	IKMLIMWLLW
PRCoV	GTASDCESCF	NRGDLIWHLA	NWNFSWSIIL	IIFITVLQYG	RPQFSWFVYG	IKMLIMWLLW
OC43	--TPAPVYIW	TADEAIKFLK	EWNFSLGIIL	LFITIILQFG	YTSRSMFVYV	IKMIILWLMW
PHEV	--TPVPVISW	TADEAIKFLK	EWNFSLGIIV	LFITIILQFG	YTSRSMFVYV	IKMVILWLMW
BoCoV	--TPAPVYTW	TADEAIKFLK	EWNFSLGIIL	LFITIILQFG	YTSRSMFVYV	IKMIILWLMW
MHV	--APQPVYQW	TADEAIRFLK	EWNFSLGIIL	LFVTIILQFG	YTSRSMFVYV	VKMILLWLMW
RatSAV	--APQTVYQW	TADVAVRFLK	EWNFLLGIIL	LFITIILQFG	YTSRSMFIYV	VKMIILWLMW
AIBV	-----CTL	DFEQSVQLFK	EYNLFITAFI	LFTIILQYG	YATRSKVIYT	LKMIIVLWCFW
SARS	-----TI	TVEELKQLE	QWNLVIGFLF	LAWIMLLQFA	YSNRNRFYI	IKLVFLWLLW
	125	135	145	155	165	175
EMCR	PLVLALSIFD	CFVNFNVND-W	VFFGFSILMS	IITLCLWVMY	FVNSFRLWRR	VKTFWAFNPE
229E	PLVLALSIFD	TWANWDSN-W	AFVAFSFFMA	VSTLVMWVMY	FANSFRLFRR	ARTFWAWNPE
PEDV	PLVLALSIFD	AWASFQVN-W	VFAFSILMA	CITLMLWIMY	FVNSIRLWRR	THSWWSFNPE
TGEV	PVVLALTIFN	AYSEYQVSRY	VMFGFSIAGA	IVTFVLWIMY	FVRSIQLYRR	TKSWWSFNPE
CaCoV	PIVLALTIFN	AYLEYRVSRY	VMFGFSVAGA	TVTIFILWIMY	FVRSIQLYRR	TKSWWSFNPE
FeCoV	PIVLALTIFN	AYSEYQVSRY	VMFGFSVAGA	VVTFALWIMY	FVRSVQLYRR	TKSWWSFNPE
PRCoV	PIVLALTIFN	AYSEYQVSRY	VMFGFSIAGA	IVTFVLWIMY	FVRSIQLYRR	TKSWWSFNPE
OC43	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWIVY	FVNSIRLFIR	TGSEWSFNPE
PHEV	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWVYV	FVNSIRLFIR	TGSEWSFNPE
BoCoV	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWIVY	FVNSIRLFIR	TGSEWSFNPE
MHV	PLTIVLCIFN	--CVYALN-N	VYLGFSIVFT	IVSIIMWIMY	FVNSIRLFIR	TGSEWSFNPE
RatSAV	PLTIVLCIFN	--CVYALN-N	VYLGFSIVFT	IVSIVMWIMY	FVNSIRLFIR	TGSEWSFNPE
AIBV	PLNIAGVIS	--CTYPPN-T	GGLVAAIILT	VFACLSFVG	WQSIIRLFKR	CRSWWSFNPE
SARS	PVTACFVLA	--AVYRIN-W	VTGGIAIAMA	CIVGLMWLSY	FVASFRLFAR	TRSMWSFNPE
	185	195	205	215	225	235
EMCR	TNAIISLQVY	-GHNYLPLVM	AAPTGVTLTL	LSGVLLVDGH	KIATRVQVGQ	LPKYVIVATP
229E	VNAITVTTL	-GQTYQPIQ	QAPTGITVTL	LSGVLYVDGH	RLASGVQVHN	LPEYMTVAVP
PEDV	TDALLTTSVM	-GRQVCIPVL	GAPTGVTLTL	LSGTLLVEGY	KVATGVQVSQ	LPNFVTVAKA
TGEV	TKAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMNIDN	LPKYVMVALP
CaCoV	TSAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLCAEGF	KIAGGMNIDN	LPKYVMVALP
FeCoV	TNAILCVNAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KMAGGLTIEH	LPKYVMATP
PRCoV	TNAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMTIDN	LPKYVMVALP
OC43	TNNLMCIDMK	-GTMVVRPII	EDYHTLTVTI	IRGHLYIQGI	KLGTGYSLSL	LPAYMTVAK-
PHEV	TNNLMCIDMK	-GRMYVRPII	EDYHTLTATI	IRGHLYIQGI	KLGTGYSLSL	LPAYMTVAK-
BoCoV	TNNLMCIDMK	-GRMYVRPII	EDYHTLTVTI	IRGHLYMQGI	KLGTGYSLSL	LPAYMTVAK-
MHV	TNNLMCIDMK	-GTVYVRPII	EDYHTLTATI	IRGHLYMQGV	KLGTGFSLSL	LPAYMTVAK-
RatSAV	TNNLMCIDVK	-GTVYVRPII	EDYHTLTATN	VRGHLYMQGV	KLGTGFSLSL	LPAYMTVAK-
AIBV	SNAVGSILLT	NGQQCNAFIE	SVPMVLSPII	KNGVLYCEGO	WLAK-CEPDH	LPKDFVCTP
SARS	TNILLNVPLR	-GTIVTRPLM	ESELVIGAVI	IRGHLRMAGH	PLGR-CDIKD	LPKEITVAT-

	245	255	265	275	285	
EMCR	STTIVCDRVG	RSVNETSQTG	WAFYVRKHHG	DFSGVASQEG	VLSEREKLLH	LI
229E	STTIYSRVG	RSVNSQNSTG	WVFYVRVKHG	DFSAVSSPMS	NMTENERLLH	FF
PEDV	TTTIVYGRVG	RSVNASSGTG	WAFYVRSKHG	DYSAVSNPSA	VLTDSEKVLH	LV
TGEV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEQEKLLH	MV
CaCoV	VRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTAR-TD	NLSEHEKLLH	MV
FeCoV	SRTIVYTLVG	KQLKATTATG	WAYYVKSAG	DYSTEAR-TD	NLSEHEKLLH	MV
PRCoV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEQEKLLH	MV
OC43	VTHLCTYKRG	FLDRISDTSG	FAVYVKSQVG	NYRLPSTQKG	SGMDTALLRN	NI
PHEV	VTHLCTYKRG	FLDRIGDTSG	FAVYVKSQVG	NYRLPSTHKG	SGMDTALLRN	NI
BoCoV	VSHLLTYKRG	FLDKIGDTSG	FAVYVKSQVG	NYRLPSTQKG	SGMDTALLRN	NI
MHV	VSHLCTYKRA	FLDKVDGVSG	FAVYVKSQVG	NYRLPSN-KP	SGMDTALLR-	-I
RatSAV	VSHLCTYKRA	FLDKVDGVSG	FAVYVKSQVG	NYRLPSN-KP	SGADTALLR-	-I
AIBV	DRRNIRYRMVQ	KYTGDQSGNK	KRFATFVYAK	QSVDTGELES	VATGGSSLYT	--
SARS	SRTLSYYKLG	ASQRVGTDSG	FAAYNRYRIG	NYKLNTDHAG	SNDNIALLVQ	--

j. Putative Orf N (Nucleoprotein)

	5	15	25	35	45	55
EMCR	-----	--MAS-----	----VN---W	ADDR-----	--AARKKF--	-----
229E	-----	--MAT-----	----VK---W	ADASEPQ---	--RGRQGR--	-----
PEDV	-----	--MAS-----	----VS---F	QDRG-----	--RKR-----	-----
TGEV	-----	--MANQGQR-	----VS---W	GDESTKT---	--RGRSNSRG	RKNNN-----
FeCoV	-----	--MATQGQR-	----VN---W	GDEPSKR---	--RGRSNSRG	RKNND-----
PRCoV	-----	--MANQGQR-	----VS---W	GDESTKI---	--RGRSNSRG	RKINN-----
CaCoV	-----	--MASQGQR-	----VS---W	GDESTKR---	--RGRSNSRG	RKNND-----
RSDACoV	MSFVPGQENA	GSRSSSGNRA	GNGILKKTW	ADQTERGQNN	GNRGRRNQPK	QTATTQ-PNT
MHV	MSFVPGQENA	GSRSSSGNRA	GNGILKKTW	ADQTERG---	-NRGRRNHPK	QTATTQ-PNA
PHEV	MSFTPGKQSS	-SRASSGNRS	GNGILK---W	ADQSDQSRNV	QTRGRRVQSK	QTATSQPPSG
OC43	MSFTPGKQSS	-SRASSGNRS	GNGILK---W	ADQSDQFRNV	QTRGRRAQPK	QTATSQPPSG
BoCoV	MSFTPGKQSS	-SRASFGNRS	GNGILK---W	ADQSDQSRNV	QTRGRRAQPK	QTATSQPPSG
SARS	-----	--MSDNGPQS	NQRSAPRITF	GGPTDSTDNN	QNGGRNGARP	KORRPQ----
AIBV	-----	--MASG-----	-----K---A	AGKTDAPAPV	IKLGGPKPPK	VGSS-----

	65	75	85	95	105	115
EMCR	----PPPSFY	MPLLVSSDKA	PYRVIPRNLV	PIGKGNK-DE	QIGYWNVQER	--WRMRRGQR
229E	----IPYSLY	SPLLVDSE-Q	PWKVIPRNLV	PINKKDK-NK	LIGYWNVQKR	--FRTRKGKR
PEDV	----VPLSLY	APLRVTNDKP	LSKVLANNV	PTNKGDK-DQ	QIGYWNEQIR	--WRMRRGQR
TGEV	----IPLSFF	NPITLQQGSK	FWNLCPDQV	PKGIGNR-DQ	QIGYWNQQR	--YRMVKGQR
FeCoV	----IPLSFF	NPITLQQGSK	FWNLCPDQV	PKGIGNR-DQ	QIGYWNQQR	--YRMVKGQR
PRCoV	----IPLSFF	NPITLQQGSK	FWNLCPDQV	PKGIGNR-DQ	QIGYWNQQR	--YRMVKGQR
CaCoV	----IPLSFF	NPITLQQGSK	FWNLCPDQV	PKGIGNR-DQ	QIGYWNQQR	--YRMVKGQR
RSDACoV	GSVVPYHSWF	SGITQFQKQK	EFQFAEGQGV	PIANGIPPSE	QKGYWYRHNH	RSFKTPDGQQ
MHV	GSVVPYHSWF	SGITQFQKQK	EFQFAEGQGV	PIASGIPASE	QKGYWYRHNH	RSFKTPDGQH
PHEV	GTVPYHSWF	SGITQFQKQK	EFQFAEGQGV	PIAPGVPSTE	AKGYWYRHNH	RSFKTADGNQ
OC43	GNVVPYHSWF	SGITQFQKQK	EFQFAEGQGV	PIAPGVPSTE	AKGYWYRHNH	RSFKTADGNQ
BoCoV	GNVVPYHSWF	SGITQFQKQK	EFQFAEGQGV	PIAPGVPSTE	AKGYWYRHNH	RSFKTADGNQ
SARS	GLPNNTASWF	TALTQHGK-E	ELRFPRGQGV	PINTNSGPD	QIGYRRATR	R-VRGGDGKM
AIBV	----GNASWF	QAIAKAKLNT	PPPKFEGSGV	PDNENIKPSQ	QHGYYRRQAR	--FKPGKGGR

	125	135	145	155	165	175
EMCR	VDLPPKVHFY	YLGTPGHKDL	KFRQRSDGVV	WVAKEGAKTV	NTSLGNRK--	RNOKPLEPKF
229E	VDLSPKLHFY	YLGTPGHKDA	KFRERVGVV	WVAVDGAKTE	PTGYGVRR--	KNSEPEIPHF
PEDV	IEQPSNWHFY	YLGTPGHGDL	RYRTRETEGV	WVAKEGAKTE	PTNLGVK--	ASEKPIIPKF
TGEV	KELPERWFFY	YLGTPGHADA	KFKDKLDGVV	WVAKDGAMNK	PTTLGSRG--	ANNESKALKF
FeCoV	KELAERWFFY	FLGTGPHADA	KFKDKLDGVV	WVARDGAMNK	PTTLGTRG--	TNNESKPLRF
PRCoV	KELPERWFFY	YLGTPGHADA	KFKDKLDGVV	WVAKDGAMNK	PTTLGSRG--	ANNESKALKF
CaCoV	KNLPEKWFFY	YLGTPGHADA	KFKDKLDGVV	WVARGDSMTK	PTTLGTRG--	TNNESKALKF
RSDACoV	QQLLPWYFY	YLGTPGHAGA	SFGDSIEGVV	WVANSQADTN	TSADIVERDP	SSHEAIPTRF
MHV	QQLLPWYFY	YLGTPGHAGA	EYGGDIEGVV	WVASQADTK	TTADVVERDP	SSHEAIPTRF
PHEV	QQLLPWYFY	YLGTPGHAKD	QYGTIDIGVF	WVASNQADIN	TPADIVDRDP	SSDEAIPTRF
OC43	QQLLPWYFY	YLGTPGHAKD	QYGTIDIGVF	WVASNQADIN	TPADIVDRDP	SSDEAIPTRF
BoCoV	QQLLPWYFY	YLGTPGHAKD	QYGTIDIGVF	WVASNQADIN	TPADILDRDP	SSDEAIPTRF
SARS	KELSPWYFY	YLGTPPEASL	PYGANKEGIV	WVATEGALNT	PKDHIGTRNP	NNNAATVLQL
AIBV	KPVPDAWYFY	YTGTPPAADL	NWGDQDQIV	WVAAGADTK	SRSNQGTTRDP	DKFDQYPLRF

	185	195	205	215	225	235
EMCR	SIALPPELSV	VEFEDRSNNS	SRASSRSSTR	-----	-----NNSR	DS-----
229E	NQKLPGVTV	VEEPD----	SRAPSRSQSR	-----	-----SQSR	-----
PEDV	SQQLPSVVEI	VEPNTTP--A	SRANSRSRSR	GNGNRSRSP	SNNRGNNQSR	GNSQNRGNNQ
TGEV	DGKVPGEFQL	EVNQS-----	-RDNSRSRSQ	-----	-----	-----
FeCoV	DGKIPPOFQL	EVNRS-----	-RNSRSRGSQ	-----	-----	-----
PRCoV	DGKVPGEFQL	EVNQS-----	-RDNSRSRSQ	-----	-----	-----
CaCoV	DVKVPSEFHL	EVNQL-----	-RDNSRSRSQ	-----	-----	-----
RSDACoV	APGTVLPQGF	YVEGS-----	GRSAPASRSG	-----	-----	-----
MHV	APGTVLPQGF	YVEGS-----	GRSAPASRSG	-----	-----	-----
PHEV	PPGTVLPQGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
OC43	PPGTVLPQGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
BoCoV	PPGTVLPQGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
SARS	PQGTTLPGKF	YAEGS-----	-RGGSQASSR	-----	-----	-----
AIBV	SDGGPDGNFR	WDFIP-----	--LN-RGRSG	-----	-----	-----

	245	255	265	275	285	295
EMCR	SRSTSQR---	-----QSR-	TRSDSNQS--	-----S-SDL	VAAVTLALKN	LGFDN--QSK
229E	GRGESKP---	-----QSRN	PSSDRNHN--	-----SQDDI	MKAVAAALKS	LGFDKP-QEK
PEDV	GRGASQNRGG	NNNNNNKSRN	QSNRRNQSD	RGGVTSRDDL	VAAVKDALKS	LGIGEN-PDR
TGEV	SRSRSRNR--	-----SQSRG	RQQFNKK--	-----DDSV	EQAVLAALKK	LGVDTE-KQQ
FeCoV	SRSVSRNR--	-----SQSRG	RHHSNNQ--	-----NNNV	EDITIVAVLEK	LGV-TD-KQ
PRCoV	SRSRSRNR--	-----SQSRG	RQSNKKK--	-----DDSV	EQAVLAALKK	LGYTE-KQQ
CaCoV	SRSQSRNR--	-----SQSRG	RQLSNNKK--	-----DDNV	EQAVLAALKK	LGVDTE-KQQ
RSDACoV	SRSQSRGP--	-----NNRA	RSSSNQRQ--	-----PASTV	KPDMAEEIAA	LVLAN---LG
MHV	SRSQSRGP--	-----NNRA	RSSSNQRQ--	-----PASAV	KPDMAEEIAA	LVLAK---LG
PHEV	SRAPNRAPS-	-----AGSRS	RANSNRT--	-----STPGV	TPDMADQIAS	LVLAK---LG
OC43	SRTSSRASS-	-----AGSRS	RANSNRT--	-----PTSGV	TPDMADQIAS	LVLAK---LG
BoCoV	SRSSRASS-	-----AGSRS	RANSNRT--	-----PTSGV	TPDMADQIAS	LVLAK---LG
SARS	SSSRSRGN--	-----SRNST	PGSSRGNS--	-----PARMA	SGGETALAL	LLLDRLNQL
AIBV	-RSTAASS--	-----AAASRA	PSREGSRG--	-----RRSDS	GDDLIARAAK	IIQDQ----

	305	315	325	335	345	355
EMCR	SPSSSGTSTP	K-----K-	---PNKPLSQ	PRADKPS---	-QLKKPRWKR	VPTR--EENV
229E	DKKSAKTGTP	KPSRNQSPAS	SQTSAKSLAR	SQSSETKEQK	HEMQKPRWKR	QPNDDVTSNV
PEDV	HKQQQPKQE	K-SDN---SG	KNTPKKNKSR	ATSKERD---	-LKDIPEWRR	IPKG--ENS
TGEV	QRSRSKSKER	S-----	---NSKTR	DTPKNE---	---NKHTWKR	TAGK---GDV
FeCoV	-RSRSKPRER	S-----	---DSKPR	DTPKNA---	---NKHTWKR	TAGK---GDV
PRCoV	QRSRSKSKER	S-----	---NSKTR	DTPKNE---	---NKHTWKR	TAGK---GDV
CaCoV	-RSRSKSKER	S-----	---NSKTR	DTPKNE---	---NKHTWKR	TAGK---GDV
RSDACoV	-KDAGQPKQV	T-----	---KQSAK	EVROKIL---	---NKPRQKR	TPNK--QCPV
MHV	-KDAGQPKQV	T-----	---KQSAK	EVROKIL---	---TKPRQKR	TPNK--QCPV
PHEV	-KDATKPKQV	T-----	---KQSAK	EVROKIL---	---NKPRQKR	SPNK--QCTV
OC43	-KDATKPKQV	T-----	---KHTAK	EVROKIL---	---NKPRQKR	SPNK--QCTV
BoCoV	-KDATKPKQV	T-----	---KQSAK	EVROKIL---	---NKPRQKR	SPNK--QCTV
SARS	SKVSGKQQQ	Q-----	---GQTVTK	KSAAEAS---	---KKPRQKR	TATK--QYV
AIBV	---QKKGSR	T-----	---KAKAD	EMAHRRY---	---CKRT	IPPN---YRV

	365	375	385	395	405	415
EMCR	IQCFGPRDFN	H---NMGDS	LVQNGVDAKG	FPQLAELIPN	QAALFFDSEV	STDEVG----
229E	TQCFGPRDL	H---NFGSAG	VVANGVKAKG	YPQFAELVPS	TAAMLFDSHI	VSKEG----
PEDV	AACFGPRGGF	K---NFGDAE	FVEKGVDASG	YAQIASLAPN	VAALLFGGNV	AVRELA----
TGEV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
FeCoV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
PRCoV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
CaCoV	TKFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSHW	TAKEDG----
RSDACoV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	PGAFFFGSKL	ELVKKN--SG
MHV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	PSAFFFGSKL	ELVKKN--SG
PHEV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
OC43	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
BoCoV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
SARS	TQAFGRRGPE	QTQGNFGDQ	LIRQGTDYKH	WPQIAQFAPS	ASAFFFGMSRI	GMEVTP----
AIBV	DQVFGPRTKG	K-EGNFGDDK	MNEEGIKDGR	VTAMLNLVPS	SHACLFGRSV	TPKLQL----

	425	435	445	455	465	475
EMCR	-----DNV	QITYT----	Y KMLVAKDNKN	LPKFIEQISA	FTKPS-----	SIKEMQSQSS
229E	-----NTV	VLFTT----	Y RVTVPKDHPP	LGKFLEELNA	FTR-----	EMQQHPLNLP
PEDV	-----DSY	EITYN----	Y KMTVPKSDPN	VELLVSVQDA	FRTGN-----	AKLQKKEKK
TGEV	-----DQI	EVTFT----	H KYHLPKDDPK	TGQFLOQINA	YARPS-----	EVAKEQQRKK
FeCoV	-----DQV	KVTLT----	H TYLPLKDDAK	TSQFLEQIDA	YKRPS-----	EVAKDQQRKR
PRCoV	-----DQI	EVTFT----	H KYHLPKDHPP	TEQFLOQINA	YASPS-----	ELAKEQQRKR
CaCoV	-----DQI	EVTFT----	H KYHLPKDDPK	TGQFLOQINA	YARPS-----	EVAKEQQRKR
RSDACoV	GVDEPTKDVY	ELQYSGAVRF	DSTLPGFETI	MKVLNENLNA	YQNQA-----	GGADVVSPPK
MHV	GADEPTKDVY	ELQYSGAIRF	DSTLPGFETI	MKVLNENLNA	YQDQA-----	GSVDLVSPKP
PHEV	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQHQE-----	DGMNMSPPK
OC43	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQQQ-----	DGMNMSPPK
BoCoV	NLDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQQQ-----	DGMNMSPPK
SARS	-----SGT	WLTYHGAIKL	DDKDPQFQDN	VILLNKHIDA	YKTFP-----	PTEPKKOKKK
AIBV	-----DGL	HLRFEFTTVV	PCDDPQFQDN	VKICDQCVDG	VGTRPKDDEP	KPKSRSSSRP

SUBSTITUTE SHEET (RULE 26)

	485	495	505	515	525	535
EMCR	HVAQNTVLN-	-----	-ASIPES---	-KPLADDDSA	IEIVNEVLH	-----
229E	SALEFNPSQ-	-----	-TSPATA---	-EPVRDEVSI	ETDIIDEVN-	-----
PEDV	NKRETTLQQH	EEAIYDDVGA	PSDVTHANLE	WDTAVDGGDT	AVEIINEIFD	TGN-----
TGEV	SRSKSAERS-	-----	EQDVVPDALI	ENYTDVFDDT	QVEIIDEVTN	-----
FeCoV	SRSKSADK--	-----	KPEELSVTLV	EAYTDVFDDT	QVEMIDEVTN	-----
PRCoV	SRSKSAERS-	-----	EQEVVPDSLI	ENYTDVFDDT	QVEMIDEVTN	-----
CaCoV	ARSKSERV-	-----	EQEVVPDALI	ENYTDVFDDT	QVEIIDEVTN	-----
RSDACoV	QRKRGTQKT-	-AQKEELDSI	SVAKPKSAVQ	RNVSRRELTPE	DRSLLAQILD	DGVVPDGLDD
MHV	PRRGRRQAQ-	-EKKDEVNDV	SVAKPKSLVQ	RNVSRRELTPE	DRSLLAQILD	DGVVPDGLDD
PHEV	QRQRGQKN--	--GQVENDNV	SVAAPKSRVQ	QNKSRRELTAE	DISLLKKMDE	P-----YTED
OC43	QRQRGHKN--	--GQVENDNV	SVAAPKSRVQ	QNKSRRELTAE	DISLLKKMDE	P-----YTED
BoCoV	QRQRGQKN--	--GQVENDNV	SVAAPKSRVQ	QNKSRRELTAE	DISLLKKMDE	P-----YTED
SARS	KTDEAQPLP-	-----	QRQKKQPTVT	LLPAADMDDF	SRQLQNSMSG	ASADSTQA--
AIBV	ATRGNSPAPR	QQRPKKEKKL	KKQDDEADKA	LTSDEERNNA	QLEFYDEPKV	INWGDAALGE
					
EMCR	----					
229E	----					
PEDV	----					
TGEV	----					
FeCoV	----					
PRCoV	----					
CaCoV	----					
RSDACoV	-SNV					
MHV	DSNV					
PHEV	TSEI					
OC43	TSEI					
BoCoV	TSEI					
SARS	----					
AIBV	NEL-					

k. 5'untranslated region (genomic sequence)

	5	15	25	35	45	55
EMCR5'UTR	-----	-----	---AGATAGA	GAATTTTCTT	ATTTAGACTT	TGTGTCTACT
229E5'UTR	ACTTAAGTAC	CTTATCTATC	TACAGATAGA	AAAGTTGCTT	-TTTAGACTT	TGTGTCTACT

	65	75	85	95	105	115
EMCR5'UTR	CCTCTCAACT	AAACGAAATT	TTT-CTAGTG	CTGTCAATTG	TTATG--GCA	GTCCTAGTGT
229E5'UTR	TTTCTCAACT	AAACGAAATT	TTTGCTATGG	CCGGCATCTT	TGATGCTGGA	GTCGCTAGTGT

	125	135	145	155	165	175
EMCR5'UTR	AATTGAAATT	TCGTCAAGTT	TGTAA-ACTG	GTTAGGCAAG	TGTTGTATTT	TCTGTGTTTA
229E5'UTR	AATTGAAATT	TCATTTGGGT	TGCAACAGTT	TGGAAGCAAG	TGCTGTGTGT	CCTA-GTCTA

	185	195	205	215	225	235
EMCR5'UTR	AGCACTGGTG	GTTCTGTC-C	ACTAGTGCAC	AC-ATTGATA	CTTAAGT-GG	TGTTCTGTCA
229E5'UTR	AGGGTTTCGT	GTTCCGTCAC	GAGATTCCAT	TCTACAAACG	CCTTACTCGA	GGTTCCGTCT

	245	255	265	275	285	
EMCR5'UTR	CTGCTTATTG	TGGAAGCAAC	GTTCTGTGCT	TGTGGAACCC	AATAACTGCT	AACC
229E5'UTR	CGTGTTTGTG	TGGAAGCAAA	GTTCTGTCTT	TGTGGAACCC	AGTAACTGTT	CCTA